

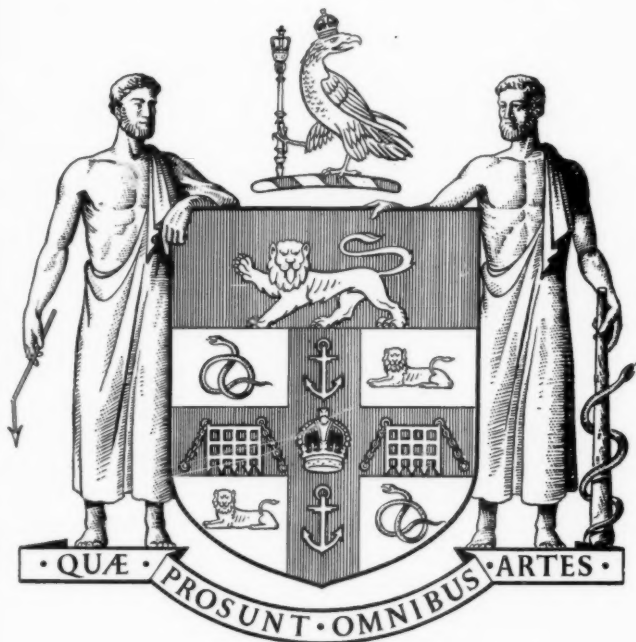
ANNALS OF THE ROYAL COLLEGE OF SURGEONS OF ENGLAND

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THE SURGICAL MANAGEMENT OF FRIEDREICH'S ATAXIA

Hunterian Lecture delivered at the Royal College of Surgeons of England

on
13th June 1957

by

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THE PRIVILEGE OF delivering this lecture fills me with a pleasure that is tempered with humility. Wherever surgical teaching and research are undertaken the profound influence exerted by the life and work of John Hunter makes itself felt. This is so in remote Jerusalem where Israel's first medical school was founded only a few years ago. I feel at once proud and humble to share with the Medical School of the Hebrew University the honour of giving this lecture.

As the rôle of surgery changes, its application becomes wider. In certain neurological disorders surgery has a palliative rather than a curative rôle to play. With the reduction of operative risk and the greater potential of operative success, a more radical approach is possible in treating the deformities created by these neurological disturbances. In cerebral palsy and in leprosy, surgery is used for the amelioration of the neurological disabilities. It is the purpose of my lecture to describe the rôle of surgery in the progressive neurological disorder known as Friedreich's Ataxia. This disease was first described by Friedreich in 1863. It is one of a group of progressive hereditary ataxias characterised by a disturbance of coordination of movement and is due to a degeneration in a part of the spino-cerebellar nervous system. It is usually transmitted on a hereditary or familial basis, but sporadic cases in which there is no previous family history also occur. Interest in Friedreich's Ataxia has centred largely on its diagnostic and genetic aspects, and the disease has not been recognised as of interest to surgeons because it is considered an inevitably progressive neurological disorder, not lending itself to surgical intervention. References to its orthopaedic management scarcely exist; where they do they are vague and inexact. I wish to present evidence that properly planned reconstructive surgery can prevent, correct or materially reduce disability in a high proportion of cases.

The first symptoms of Friedreich's Ataxia appear in childhood or early adolescence. There is a tendency to be clumsy and awkward, to stumble and fall easily and there may be difficulty in mounting stairs. Ankle sprain is frequent. There is difficulty in obtaining shoes that fit, and they become badly misshapen and are worn out too rapidly. Over the years a slow insidious deforming of the feet occurs. There is a concurrent loss of kinaesthetic sensibility and the patient walks on a broad base, tending to reel and stagger. He is unable to walk in a straight line and raises his arms to help him maintain his balance. The rate of progress of the disease

varies greatly from case to case, but the rate of progress is often similar in siblings or members of the same family. Within a decade of the onset of the ataxia the patient is often unable to walk without assistance. In the later stages, movements of the upper limbs also become ataxic and an intention tremor is present. Speech is dysarthric, slow and slurred. During the third and fourth decades of life, many patients become house-bound and finally bedridden.

The various sites of degeneration in the spino-cerebellar nervous system produce a diversity of symptoms and account for the numerous eponymous syndromes. There are many transitional forms which lie between the boundaries of Friedreich's Ataxia, Charcot-Marie-Tooth Peroneal Muscular Atrophy and the Roussy-Lévy Syndrome. Roth (1948) has reported cases where a familial connection has existed between Friedreich's Ataxia and peroneal muscular atrophy. The Roussy-Lévy Syndrome is considered by some to be a "forme fruste" of Friedreich's Ataxia, so that there is no sharp demarcation line separating these diseases. Occasionally cases occur showing only unilateral defect.

This study is based on a combined series of cases comprising forty-five cases of Friedreich's Ataxia treated by surgery at the New York Orthopaedic Hospital during the twenty-year period 1931-1951, and a further six cases treated at the Orthopaedic Department of the Rothschild-Hadassah University Hospital, Jerusalem, between 1952 and 1957. Upon analysis, these cases are divisible into three main groups.

Group I—Those in whom the neurological ataxia was dominant and in whom the foot disability was mild.

Group II—Those with severe foot deformity in whom the ataxic symptoms were minimal; and

Group III—Those cases showing ataxia combined with severe foot disability.

It should be borne in mind that the cases used in this study were those seeking or being referred for orthopaedic treatment. Other cases in which severe ataxia was the dominant symptom would not be referred to the orthopaedist. The picture of Friedreich's Ataxia presented in this study must therefore lack true perspective.

The study shows that the progress of the disease is not relentless and inevitable and that the rate of progress is highly variable. It may be so slow as to be impossible to define; or else the progress is arrested altogether. This latter abortive type, in which the disease usually becomes static once adult life is reached comprises one third of the total cases. These abortive cases are more common in the predominantly "spinal" forms of the disease where there are few signs of cerebellar involvement. It has been noted that the first signs of ataxia sometimes appear following a general infection, such as scarlatina or typhoid. This has led to the supposition that the infection has precipitated the ataxia. In a normal subject, there is well-recognised muscular weakness after a

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debilitating illness that causes instability of gait and stumbling. In the mild unrecognised ataxic this muscular weakness following the debilitating illness only serves to exacerbate what was previously considered clumsiness, which then becomes evident as a frank ataxia.

In this series, foot defect was usual (Fig. 1). Fixed equinus deformity was present in over half of the total cases (57 per cent.) and varus deformity



Fig. 1. The typical foot deformity, severe bilateral claw foot. The marked equinus of the forefoot causes the deep flexion crease in the sole.

presented in just under half of the series (48 per cent). Symmetrical claw-foot was usual; 84 per cent. of cases showed marked cavus deformity and 73 per cent. claw toes. The clawfoot has a high longitudinal arch, a wide forefoot with prominent metatarsal heads and hyperextension of the toes which are not in contact with the ground. The great toe is dorsiflexed at the metatarso-phalangeal joint and plantarflexed at the interphalangeal joint. This has been called the "Friedreich's toe." Forty-nine of the total fifty-one cases had foot deformity, and in thirty-three cases there was definable muscle weakness, involving the foot dorsiflexors and peroneal muscles (Table I). Two cases showed in addition paralysis of the triceps

MYER MAKIN



Fig. 2



Fig. 3

Figs. 2 and 3. The characteristic "intrinsic minus hand."

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same muscles. In the foot, muscle imbalance seems to be the major factor in the genesis of the foot deformity. The main deforming factor appears to be the posterior tibial muscle which is unopposed due to weakness or paralysis of the muscles innervated by the common peroneal nerve.

TABLE I
DISTRIBUTION OF MUSCLE INVOLVEMENT IN FORTY-NINE PATIENTS WITH
FOOT DEFORMITY

Muscle weakness or paralysis..	..	..	..	..	..	..	33 cases
Peroneal ..	..	..	..	..	..	8	
Anterior tibial ..	..	..	..	..	..	2	
Peroneal and anterior tibial ..	..	..	..	..	..	10	
All foot dorsiflexors ..	..	..	..	..	..	10	
Total absence of all foot dorsiflexors ..	..	..	..	..	..	1	
Flaccid paralysis of all foot musculature ..	..	..	..	..	..	2	
Normal musculature ..	..	..	..	..	..	..	10
Unrecorded ..	..	..	..	..	..	..	6
Total ..	..	..	..	..	..	..	49

There was a definite predictable pattern of muscle weakness. The quadriceps and hamstring muscles were rarely affected. Early in the course of the disease, the musculature around the hip joint, particularly the gluteal muscles, are weakened. This gives rise to a lurching, unstable gait. In the upper limb there is relative integrity of the muscles of the elbow and shoulder, but a weakness and atrophy of the intrinsic muscles of the hand becomes apparent (Fig. 2 and Fig. 3). Hence the characteristic "monkey fist" or what Bunnell (1942) calls "the intrinsic minus hand." Weakness of the hand leads to clumsiness, difficulty in grasping and may interfere with the use of crutches.

Foot deformity and muscular weakness of the lower limbs combine to produce an unstable gait. Gluteal weakness causes a lurching gait. An otherwise normal person could compensate by adequate balance. The ataxic cannot. The neurological ataxia caused by a loss of proprioceptive sensibility exacerbates the instability of the lower limbs. The failure to compensate increases the ataxia. The ataxia is thus compounded of two factors, the neurological ataxia and that resulting from musculo-skeletal disability. The second aggravates the first, so that a mild ataxia of neurological origin becomes a severe ataxia because of the associated disability. Russell Brain (1955) has pointed out that "ataxia of the lower limbs is usually less evident in movement of the limbs individually when the patient is lying in bed." It would seem that when the factors of foot instability and deformity have been eliminated a decrease of the ataxia is evident. The foot instability and deformity are frequently responsible for abnormalities of gait and stance. These physical factors may therefore be as potent a cause of ataxia as the neurological disturbance itself.

In the New York series a total of 152 cases of Friedreich's Ataxia were diagnosed in the twenty-year period from 1931-51. Out of this number fifty-two cases, or roughly one-third, were advised surgery. Five cases refused operation, there was a diagnostic error in two cases, leaving forty-five for study. Added to this are six Jerusalem cases, making a total

of fifty-one operative cases, of whom twenty three were male and twenty-eight female. Age at operation ranged from nine to thirty-eight years and averaged 15.2 years. The average age at which the disease was first recognised was 9.8 years.

Forty-nine patients had surgery performed on their lower limbs. Four patients had only unilateral foot involvement so that operations were carried out on a total of ninety-four feet. Thirty-four of the patients had multiple operations performed necessitating two or more admissions to hospital. Spine fusion was undertaken to correct scoliosis in two patients, and in one case to prevent advancing round back deformity. Scoliosis when present was usually mild and non-progressive. It was detected only by routine clinical examination and was not a usual presenting symptom.

The basic procedure in dealing with foot deformity and muscle imbalance was a triple arthrodesis, involving resection of the talo-calcaneal, talo-navicular and calcaneo-cuboid joints with correction of the deformity by adequate wedging of the resections. Hibbs (1919) first noticed that in typical clawfoot the main deformity was around the midtarsal joint and that the apparent equinus could together with the cavus be eliminated at the time of the sub-talar stabilisation by adequate bone resection.

Triple arthrodesis was performed in forty cases. Tendon transplantation was usually undertaken from six to eight weeks following foot stabilisation. This was done in twenty-one cases. Anterior transposition of the posterior tibial tendon is here the most logical procedure. By this means, the main deforming factor causing cavo-varus is removed and the muscle is converted into an active dorsiflexor of the foot. The transplanted muscle, as has been shown, is unlikely to become affected by the progress of the disease (Table II).

Before deciding to operate, it is advisable to know the rate of progression of the disease. The patient should be kept under observation for a year or two or his history should be well known. Cases in which there is a rapid progression of the neurological disability are not suitable for operation. The objectives of surgery in the abortive forms of the disease are to correct the deformity so as to allow normal or near normal gait, and, in the progressive type, to provide a stable base in order to delay the effects of the progressive ataxia. Following surgery the house-bound patient occasionally may be taught to stand and to walk again independently. Locomotor ability is a process learnt by the central nervous system and may through disuse be lost, particularly if the degenerative process produces an incoordination of movement. The patient who has lost this faculty for independent locomotion due to ataxia, muscular hypotonia, foot deformity and paralysis finds the relearning process prolonged and difficult, even after the foot deformity and paralysis have been corrected (Figs. 4 (a) and (b), 5 (a) and (b)). When surgery is undertaken, a prolonged period of bed rest is contraindicated and the patient should be mobilised as soon as possible.

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TABLE II
TYPES OF PROCEDURES

	No. of patients	No. of feet
<i>Stabilisations:</i>		
Triple arthrodesis	40	75
Naughton Dunn arthrodesis	2	2
Pantalar arthrodesis	4	7
<i>Tendon transfers and tendoplasties</i>	16	29
Extensor digitorum longus to middle cuneiform	18	29
Extensor hallucis longus to first metatarsal	18	34
Extensor digitorum longus and extensor hallucis longus to middle cuneiform	2	4
Anterior tibial to middle cuneiform	1	1
Posterior tibial transfer	2	4
Calcaneal tendon lengthening	5	8
Tenotomy of posterior tibial	3	6
<i>Other procedures on the feet:</i>		
Plantar fasciotomy	25	46
Osteotomy of first metatarsal	12	21
Arthrodesis of proximal interphalangeal joints	8	12
Amputation of fifth toe	4	7
Arthrodesis of interphalangeal joint of hallux	21	39
Dorsal wedge resection of foot	2	2
Arthrodesis of metatarsocuneiform joint	1	1
Revision of arthrodesis	6	6
<i>Other procedures:</i>		
Spine fusion	3	—
Opponens Tendon transfer to thumb	1	2 hands



Figs. 4(a) and (b). Case S.C. Foot deformity before correction.

The disease has a typical pattern of progression and corrective procedures must allow for its development. No specific operative procedures can be laid down for all cases. Each case presents its own problems. This indeed accounts for the variety of operations used in the series presented. Even in the milder cases bone surgery should be performed early so as to arrest progressive deformity; less bone is sacrificed and



Figs. 5(a) and (b). Case S.C. Following correction of foot deformity.

correction is technically easier. In children, bone surgery is routinely avoided until bone maturity is adequate.

I now wish to report to you three cases, each one typical of its kind. The first is a classic case of the slowly progressive form of Friedreich's Ataxia.

Case 1.—A twelve-year-old boy was first seen in 1937. He had a three-year history of bilateral progressive foot deformity, unsteady gait and frequent falling. The boy had been brought for treatment because of the disturbance of his locomotor ability and frequent fallings were interfering with his schooling. Examination then showed severe bilateral pes-equinovarus and claw toes. The peroneal muscles were markedly weakened bilaterally. Neurological examination showed knee jerks to be present, ankle jerks to be absent and a bilateral Babinski response. There was nystagmus but no sensory disturbance. The diagnosis of Friedreich's Ataxia was made. After two years' surveillance in 1939 bilateral triple arthrodeses were performed, followed six weeks later by transplant of the extensor hallucis longus to the neck of the first metatarsal and interphalangeal arthrodesis of the hallux. Following operation he had a reasonably good gait and could walk for more than a mile. The boy continued his normal schooling. Seven years after operation examination revealed further progression of the ataxia, and incoordination of gait was more pronounced. Twelve years after operation the patient was still able to walk, but had a markedly waddling gait due to gluteal weakness. His feet were in good position and although his vision was very poor he was independently mobile. Here as a result of operation there was a noticeable improvement of gait due to the correction of foot deformity, but operation had achieved something still more important—it had delayed the day when the patient would have to become bedridden.

Case 2.—This second case represents the abortive non-progressive type of Friedreich's Ataxia. An eighteen-year-old male first seen in 1939 complained that during the preceding five months he had suffered from excessively painful feet. He reported that his feet had been deformed from childhood, but had not

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previously troubled him. Examination showed bilateral claw-foot with high arches and claw toes. There were heavy callosities under the metatarsal heads. The patient's gait was essentially normal. Neurological examination showed that the knee jerks were depressed but present; the ankle jerks were absent and there was a bilateral Babinski response. Nystagmus was present, and there was a loss of vibration sense in the lower limbs. One year later, bilateral triple arthrodeses and plantar fasciotomies were undertaken, followed two months later by tendon transplants and interphalangeal arthrodesis of the hallux. The fusions solidified in good position and the tendon transplants worked well. The patient was readmitted to hospital in 1942 and 1946 for correction of hammer toe deformities. Last examined thirteen years after the original operation, the patient's feet were in good position, and he reported that he could walk and run as well as anyone else. He had served in the American armed services for three years and now worked as a draughtsman. In this case the main manifestation of this disease was the foot deformity. This was corrected by operation, following which the patient was able to lead a normal life.

Case 3.—Shows the value of surgical intervention in the rapidly progressive type of Friedreich's Ataxia. An eighteen-year-old male was first seen in 1944 when he reported that for the previous five years he had noticed a peculiarity of gait and a tendency to stumble. Examination showed instability with a tendency to stagger and a high steppage gait. All the foot dorsiflexors were rated weak; both hands showed marked wasting of the intrinsic muscles and weakness of opposition. Neurological examination showed the absence of knee and ankle jerks and a bilateral Babinski response. There was a loss of vibration sense in the legs, ataxia of the lower limbs and marked nystagmus. The patient failed to attend at the hospital again until 1948; he then complained that for the past eight months his stance had been very insecure, so that when he stood he tended to move backwards in order to maintain his balance. Examination showed that both feet were essentially flail, and that he lacked effective grip in both hands due to lack of thumb opposition. In 1948 pantalar arthrodesis were undertaken on both feet and opponens transplants were performed on both hands. The patient was last seen in 1952, that is, four years after the original operations. He was working full-time in a carton factory, where a good deal of activity and long periods of standing were required. He walked without a noticeable limp despite his bilateral pantalar arthrodesis. Cosmetically wasting of the intrinsic muscles of the hands was very marked, yet the patient had good grip due to the effectiveness of the opponens transplants. This was a case of unusually widespread muscle paralysis, with excellent results following radical surgery. Rehabilitation, though probably temporary, was achieved. The case seems liable to continue to progress rapidly. This patient, though probably only helped temporarily, would have become house-bound and eventually bedridden much earlier failing surgical intervention. Surgery has been the means of his continuing a normal life which would otherwise have been denied him.

These three cases afford examples of the value of surgery in the slowly progressive, the non-progressive and the rapidly progressive types of Friedreich's Ataxia.

End-results

Friedreich's Ataxia in its normal form is a slowly progressing disease. It is, therefore, of little value to assess results of treatment unless a long follow-up is undertaken. In this study it was considered reasonable to assess the results of surgery after a minimal period of three years. Of the fifty-one cases, seven were lost to end result study, and in seven cases

surgery was too recent for evaluation. One patient died in a mental home nine years after operation. This left thirty-six patients for study and assessment of end results. The average follow-up period was 7.2 years. Eight patients have been followed for more than ten years; ten patients were followed for between six and ten years, and eighteen from three to five years. No deaths resulted from surgery. None of the fifty-one cases showed any unusual rapid progression of the neurological disorder following operation. The conception that operation in some way exacerbates the rate of progression was not borne out.

It is noted that where complete correction of foot deformity was not achieved, the cause was traceable to errors of surgical technique. Two operative failures occurred and must be classed as total functional failures. Twenty-four of the final thirty-six patients led full and useful lives and enjoyed full functional activity. All patients in this group were grateful for operation and satisfied with the results. Eight cases showed improvement after operation but suffered moderate restriction of activities. They were restricted by their ataxia and muscle weakness but had improved gait and increased mobility as a result of operation. One patient, who had a bilateral triple arthrodesis, became bedridden five years after operation. Another, nine years following surgery, was house-bound due to muscular hypotonia and ataxia.

I hope that I have been able to make clear to you that the locomotor disturbance present in Friedreich's Ataxia is due to inherent neurological factors and to musculo-skeletal disabilities. The instability and structural deformities are frequently responsible for abnormalities of stance and gait, and these physical factors may be as significant a cause of dysfunction as the ataxia itself. Correction and prevention of foot deformity aids normal locomotion and thereby extends the patient's mobility. Thus, the day that he must eventually become bedridden is postponed. In the abortive type of the disease, surgical correction of the deformity is of permanent value.

ACKNOWLEDGMENTS

The study I have described was made possible only by the interest and encouragement of Dr. Alan de Forest Smith, Emeritus Professor of Orthopaedic Surgery at Columbia University and of the staff of the New York Orthopaedic Hospital. I must also record my gratitude and thanks to the Hadassah Medical Organization, Jerusalem, Israel, and to its Director, Dr. K. J. Mann, who has given me constant and unstinting support and provided facility for this study.

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THE SURGICAL TREATMENT OF URINARY TUBERCULOSIS

Lecture delivered at the Royal College of Surgeons of England

on

9th April 1957

by

Ronald W. Reid, M.S., F.R.C.S.

Surgeon, Essex County Hospital

THE TREATMENT of tuberculosis has improved steadily during the present century ; since the introduction of streptomycin and other anti-tuberculous drugs progress has been spectacular, especially in pulmonary and meningeal disease ; but all credit should not be given to the new antibiotics ; many other factors must be taken into account including better preventative medicine and case finding, early diagnosis and new techniques in treatment. The new antibiotics have influenced the treatment of all forms of tuberculosis and have also given rise to new problems and new difficulties. The fundamental principles governing the treatment of tuberculosis remain the same and, since tuberculosis is often such a slow and relentless disease, many years must pass before a reasoned judgment can be passed on the influence of the new drugs and the new techniques.

Pathogenesis

Osler said that " as is our pathology, so is our practice." This to-day is true throughout the whole field of medicine and surgery and nowhere does it apply with more force than in the field of tuberculosis. Osler's words, spoken at a time when medicine was more circumscribed than it is to-day, are liable to be forgotten especially by surgeons who may be hard pressed to keep up with new conceptions of disease and technical advances.

It is self-evident that urinary tuberculosis is never a primary lesion because tubercle bacilli cannot invade the urinary system directly from sources of infection outside the body. It is always secondary to some internal focus of infection which may be primary or secondary, which may or may not be discoverable. The main reservoirs of infection in the community are patients with open respiratory tuberculosis and tuberculous cattle, from these sources of infection tubercle bacilli gain entrance to the body by way of the respiratory or alimentary tract. Bacilli gaining a foothold are held up in the lymphatic system forming a primary complex in the neck, thorax or abdomen. The fate of living tubercle bacilli in the tissues depends upon the inter-action of several forces. First the force resulting from the combination of the number and virulence of the invading bacilli ; secondly the combined native and acquired resistance of the host ; and thirdly the tissue hypersensitivity, which develops as a result of the presence of the invading tubercle bacilli. In most cases tubercle bacilli are incarcerated or destroyed and the disease arrested at

the primary site leaving the host with some acquired resistance. However, in some cases the host resistance may be overcome and progressive tuberculosis develops resulting in a break-through to the blood stream. Under conditions adverse to the patient there may be an overwhelming and fatal infection before there is time for the development of a satisfactory resistance or even a local metastatic lesion. In circumstances less unfavourable to the host, lesions may spring up anywhere in the body including the genito-urinary tract, and when nature's resistance is very high and there has been time for the development of a powerful acquired

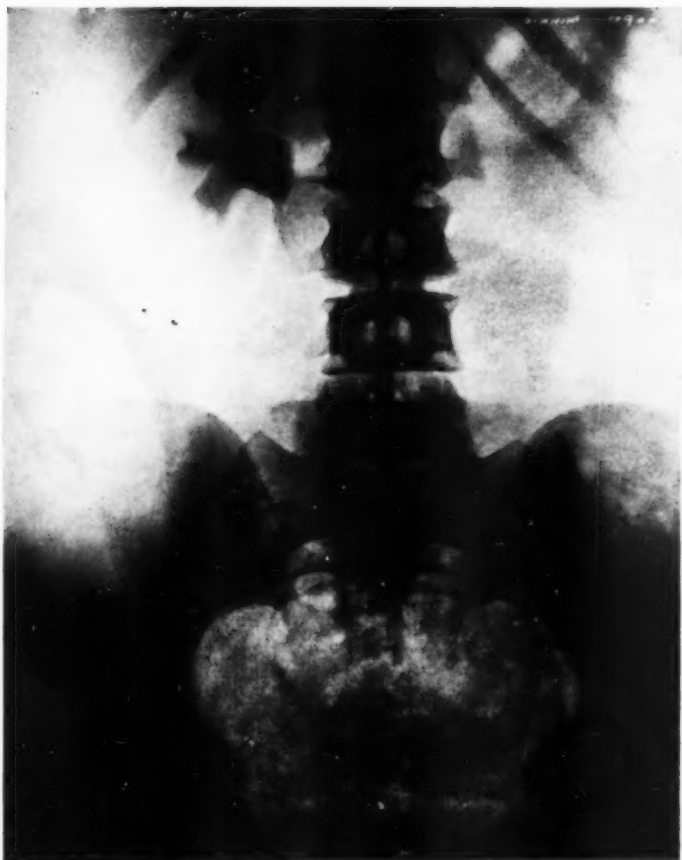


Fig. 1. Excretory pyelogram from patient, M.C., a female aged twenty-five, in 1950, showing general dilatation of pelvis and calyces due to tuberculosis in a solitary kidney.

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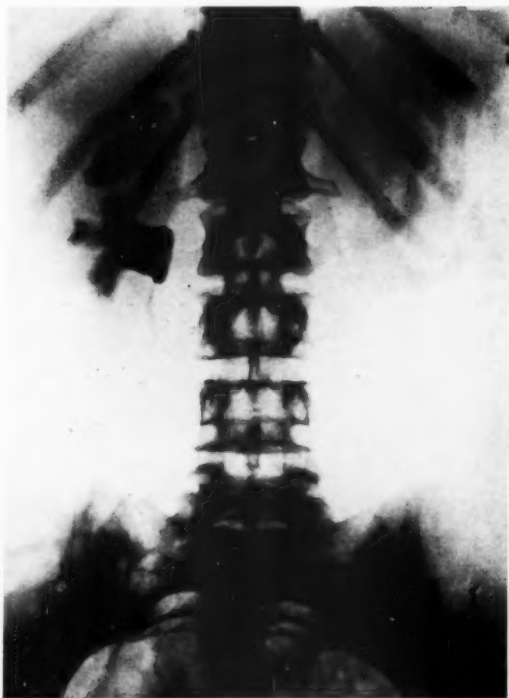


Fig. 2. Excretory pyelogram from the same patient, M.C., in 1955, after conservative treatment with the exception of streptomycin, to which the patient was sensitive. The dilatation has diminished but the upper calyx is dilated owing to stenosis between it and the pelvis.

resistance, little harm may follow bacilluria. Rich has stated that the subjects of long standing chronic tuberculosis commonly have bacilluria and that the bacilli discharged into the blood stream and lodging in the various organs do not usually produce progressive tuberculosis where they are arrested.

From primary foci of infection in the glands of the neck or alimentary tract, blood stream infections will generally tend to be held up in the lung. It is, in fact, not uncommon to obtain a history of tuberculous pleurisy some months before the onset of urinary tuberculosis; Cibert in a series of 978 cases found that 20.4 had suffered from pleural effusion. Haematogenous spread from foci in the lungs will tend to cause lesions in any tissues supplied by the systemic circulation.

The kidneys are two of the most vascular organs in the body whose function it is to maintain the physico-chemical constancy of the body

fluids. In the renal cortical areas the blood passes through the glomeruli and other fine capillaries and it is reasonable to assume that bacillary emboli will be held up or actively removed from the blood stream by the renal cells unless they are so small that they pass through the vascular channels without hindrance. It is probable also that, unless the emboli are very few in number, they will be distributed widely and evenly between the two kidneys. The effects of invasion of the kidneys will depend upon the interaction of the forces already mentioned; the organisms may be destroyed with minimal tissue reaction or progressive disease may ensue with tissue necrosis caused by the direct action of bacillary toxins, by the allergic response in highly sensitised patients and to some extent by endarteritis, which is a characteristic change in tuberculous inflammation. The characteristic necrosis of tuberculosis is caseation, in which a cheesy avascular material, usually containing tubercle bacilli, is surrounded by



Fig. 3. Ascending pyelogram from a case, J.P., a woman aged thirty-five, showing complete stenosis of two main calyces on the right side and quiescent tuberculosis of the upper lumbar vertebrae.

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Fig. 4. Ascending pyelogram from a case, C.O., a male aged forty-four, showing left renal tuberculosis with early cavity formation and on the opposite side slight dilatation of the upper main calyx. Tubercle bacilli were recovered from both sides. Patient made a satisfactory recovery after left nephrectomy and sanatorium treatment.

granulation tissue which in time tends itself to become avascular. Thus a barrier is laid down between the living and the dead tissue, a process which may be advantageous to the patient but, at the same time, it may prevent the access of drugs such as streptomycin contained in the blood stream. From this it follows that specific chemotherapy is most likely to be successful in the early stages before there is much caseation when drugs in high concentration in the blood can be brought into intimate contact with living bacilli in the tissues.

Tubercle bacilli in the urine

Identification of tubercle bacilli in the urine is the most important single investigation of a case of urinary tuberculosis. Since the bacilli may appear in the urine only intermittently, except in advanced disease, large

volumes of urine should be searched on frequent occasions before negative results are accepted. Generally the night urine with that passed on waking gives reliable results. The deposit should be examined by suitable staining, the urine cultured on special media and guinea pig injection employed as well. The test results are not always in agreement, but this is understandable since the numbers of bacilli in the urine may rapidly diminish with treatment, especially by the specific drugs. Guinea pig injection is the most sensitive test and no important conclusions should be drawn or decisions regarding treatment taken without its use.

It has long been known that patients suffering from phthisis or other forms of tuberculosis may have tubercle bacilli in their urine on many occasions without subsequently developing frank renal disease. This has given rise to the opinions often expressed that the kidneys may actually excrete bacilli and remain unharmed thereby, but the research of Medlar and Sassano, amongst others, has shown that such is not the case and that tubercle bacilli in the urine indicate without doubt that lesions exist



Fig. 5. Ascending pyelogram from a case, E.O., a male aged twenty-two, showing right sided tuberculosis with dilatation of calyces, pelvis and ureter due to obstruction, and old healed tuberculosis of the fourth and fifth lumbar vertebrae, probably in early childhood. There is no history of spinal disease, which must have healed spontaneously.

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Fig. 6. Ascending pyelogram showing advanced ulcero-cavernous tuberculosis on the right side with normal outline on the left, on a female aged twenty-two.

in the kidneys and that such lesions, often undetectable in life, heal spontaneously leaving evidence in the form of scars in the kidney cortex or medulla. It may be accepted therefore in practice that tuberculous bacilluria means a tuberculous lesion in the urinary tract.

In the natural history of a tuberculous infection as it affects human beings, the exact stage at which insemination of the kidneys takes place is not clearly known. It rarely occurs in the primary stage except in patients who are excessively fragile; it is not a common complication of chronic, long established phthisis and it is found most frequently in the secondary stage of the disease which follows blood stream spread. We know that the kidneys show a tendency to heal tuberculous lesions and that the early diagnosis of parenchymatous lesions is very difficult, for symptoms are often slow in developing, bacilluria is intermittent, and pyelogram changes late to appear. Renal tuberculosis is often found in patients with skeletal disease during or after treatment and I believe that

renal lesions very often lie dormant for many years in a state of intermittent grumbling activity as the case illustrated here shows (Fig. 3).

Pathology

Renal tuberculosis is usually exemplified by the ulcero-cavernous lesion, an advanced form of the disease in which the kidneys are partly or totally excavated and destroyed. This is comparable to advanced fibro-caseous pulmonary tuberculosis of which the manifold pathological changes have counterparts in urinary disease. Soft infiltration, caseation, necrosis, fibrosis and distortion of the bronchi or urinary ducts all play their part in the process which is naturally modified by differences in the structure and function of the organs affected. The first phase of renal tuberculosis



Fig. 7. Ascending pyelogram from a female, G.S., aged forty-five, showing bilateral renal tuberculosis with chronic dilatation and cavitation on both sides and old healed tuberculosis of the lower lumbar vertebrae. The spinal disease occurred at the age of five and the patient has been known to have bilateral renal tuberculosis for over twenty years. The patient was treated in a sanatorium for the renal tuberculosis before the introduction of antibiotics and is in good health and symptom free. Occasionally tubercle bacilli are discovered in the urine which is otherwise normal but renal function is slowly deteriorating.

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Fig. 8. Ascending pyelogram from patient, W.C., a male aged fifty-five, whose right kidney was removed twenty years ago for renal tuberculosis and who was admitted fifteen years later with anuria due to obstruction at the pelvi-ureteric junction by a lower polar vessel which was divided at operation. The patient made a satisfactory recovery.

in which soft non-caseating lesions are scattered about the renal substance is comparable to soft infiltration of the lungs and is known as tuberculosis of the renal parenchyma. This form of the disease has long been known, but it is difficult to diagnose accurately even with all the modern diagnostic techniques available. It is a form of the disease which gives rise to tuberculous bacilluria and has a natural tendency to heal; since there is no gross caseation it should be affected quickly and decisively by chemotherapy. While parenchymatous renal tuberculosis usually heals leaving only fibrous scars it may progress to widespread necrosis; the necrotic areas either become an encapsulated tuberculoma or break into the pelvic cavity and discharge down the urine stream. Thus an ulcero-cavernous lesion develops and the urine becomes loaded with tubercle bacilli and

pus, infection spreads to the pelvis, ureter and bladder either directly along the mucosa by the intra-mural lymphatics or by the direct infection from the urine stream. Subsequent inflammatory reaction interferes with the natural muscular activity of the ureter leading to stasis and dilatation, the most intense reaction being where the ureter passes through the bladder wall. The pathological process which we have so far considered is then modified by the addition of urinary obstruction and as the pressure within the ureter rises, the calyces undergo clubbing, the pelvis and ureter dilate and elongate behaving like other muscular tubes in the body under similar influences. As time goes on the bladder becomes involved and the once active and valve-like ureteric openings lose their function and are

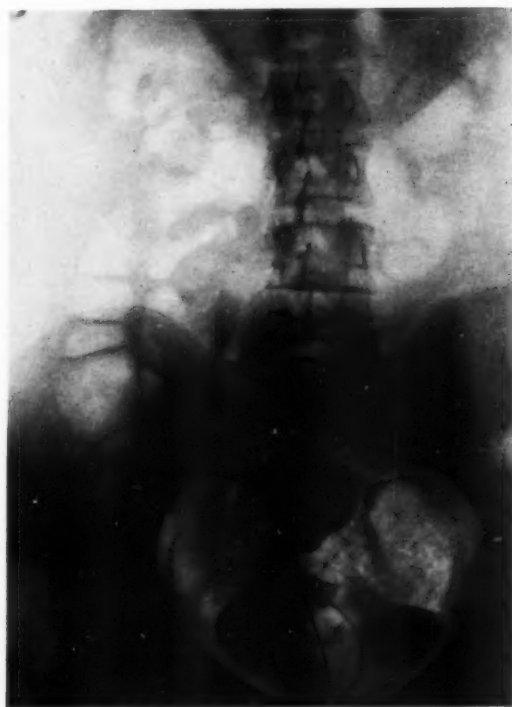


Fig. 9. Cystogram from W.B., a female aged forty, showing a loop of ileum which was used to replace the lower ureter which was stenosing and to increase the bladder capacity. Patient's left kidney had been removed for tuberculosis twenty years previously and the remaining kidney was tuberculous. The patient was treated in a sanatorium with antibiotics which cleared up the active tuberculosis but stenosis remained and caused rapid deterioration of renal function. The patient is now well and her urine free from tubercle bacilli but she suffers from bouts of frequency of micturition.

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either stenosed or stand open and inert, so that every rise in pressure within the bladder is reflected to the kidneys and ureters above. There is progressive dilatation and clubbing of the calyces, further foci break out from the parenchyma and tuberculous inflammation aided by back-pressure completes the destruction of all functioning renal tissue. Sometimes the bladder is remarkably tolerant of tubercle bacilli in the urine and may long remain unaffected, but once lesions develop there, inflammation spreads throughout the wall reducing the capacity of the bladder progressively until in the end a thick-walled sac is all that remains of the normally capacious bladder.

In the male, renal tuberculosis is almost always associated with disease in some part of the genital tract, but in the female such combined lesions are rare. The probable explanation is that tubercle bacilli are carried from the bladder to the male genital organs by way of the urine passing along the prostatic or seminal ducts. Borthwick, in 1940, reviewed 402 cases of tuberculous epididymitis and concluded that in genito-urinary tuberculosis infection proceeded from the kidney to the prostate and vesicals and then to the epididymes and that in the majority of cases such spread took place by way of the lumen of the vas deferens. In my experience 90 per cent. of patients with renal tuberculosis have evidence in the prostate or seminal vesicals of disease of similar origin. Genital tuberculosis in the female is not associated with renal disease, but is a more common complication of pulmonary tuberculosis and gives rise to plastic peritonitis with bilateral infection of the tubes, ovaries and uterus.

From this review the following may be accepted as working principles :

1. Urinary tuberculosis is haematogenous in origin and is a local manifestation of a general disease.
2. Tuberculosis of the renal parenchyma before caseation has occurred may heal leaving the kidney apparently undamaged.
3. The development of the renal lesion depends upon the dose and virulence of invading bacilli, upon the effects of tissue hypersensitivity and local endarteritis and upon the effects of back-pressure due to changes in the urinary ducts.

Treatment

In general terms the aims of treatment are to cure the patient of infection, relieve his symptoms and send him back to normal life. Treatment does not differ in principle from that of pulmonary, skeletal and other forms of the disease which are all local manifestations of a general infection. Treatment therefore consists of general constitutional measures, the use of specific antibacterial drugs and carefully planned and timed operations. Of constitutional treatment the essential elements are rest in a sanatorium in the open air, warmth and a good nutritious diet, and, since the patients very often must spend several months away from home, it is important that financial and social anxieties be relieved whenever possible. It is difficult to lay down hard and fast rules about the duration

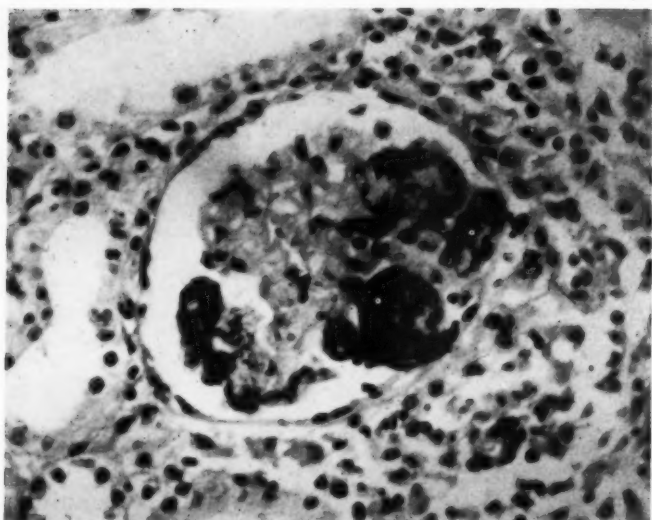


Fig. 10. Section stained by Zeihl-Neelsen method showing glomerulus packed with tubercle bacilli, black in photo-micrograph ($\times 350$).

of constitutional treatment, so much depends upon the general state of the patient and changes in the local lesions. Less than three months' treatment in a sanatorium is probably useless in the average case and a year or two may be required for those suffering from severe tuberculosis with multiple lesions. Rest is a primary requirement of treatment and all patients with active disease should be put to bed and kept there until their lesions have been accurately estimated, and until all signs of toxæmia have disappeared and the blood sedimentation rate improved.

Chemotherapy

Streptomycin, P.A.S. and isoniazid all have powerful inhibitory effects on tubercle bacilli and their introduction has had important effects on the treatment of all kinds of tuberculosis. Careful trials have been made but they are difficult in urinary disease which is insidious and slow in development; also objective evidence concerning the phase of disease is difficult to obtain especially in early cases when chemotherapy may be of particular value. Experience suggests that the drugs are most efficacious in parenchymatous tuberculosis and that they have less effect on the established ulcero-cavernous lesion. Chemotherapy can destroy the bacilli but the tissues involved may be so damaged and distorted by fibrosis that their function will be seriously impaired. Fibrosis affecting the kidney reduces the amount and efficiency of secreting tissue and when it involves any part of the urinary channel from the calyces to the bladder

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neck it may, and usually does, cause obstruction. The common sites are the neck of the calyces, the pelvis itself, the lower end of the ureter, the bladder and, more rarely, the urethra.

The possible effects of active tuberculosis in the kidney, apart from general ill-health, are:

1. Local destruction of renal tissue.
2. Infection of the lower urinary tract from calyces to bladder.
3. Distant dissemination of disease.

The extent of local destruction in the kidney depends partly upon the dose and virulence of the bacilli as has already been stated, partly upon allergic reaction, partly upon fibrosis and endarteritis causing ischaemic necrosis, a process similar to that in bones, joints and lungs. As healing supervenes and the active phase passes, necrotic renal tissue may either be encapsulated or break into the calyces of the kidney and discharge down the ureter. Similarly in the lungs a tuberculoma may break into a bronchus and so form a cavity, or may remain encapsulated and eventually surrounded by dense fibrous tissue. In Pott's disease a tuberculous para-vertebral abscess may become entirely encapsulated and shut off from the spine which gave rise to it, or may discharge on the surface of the body.

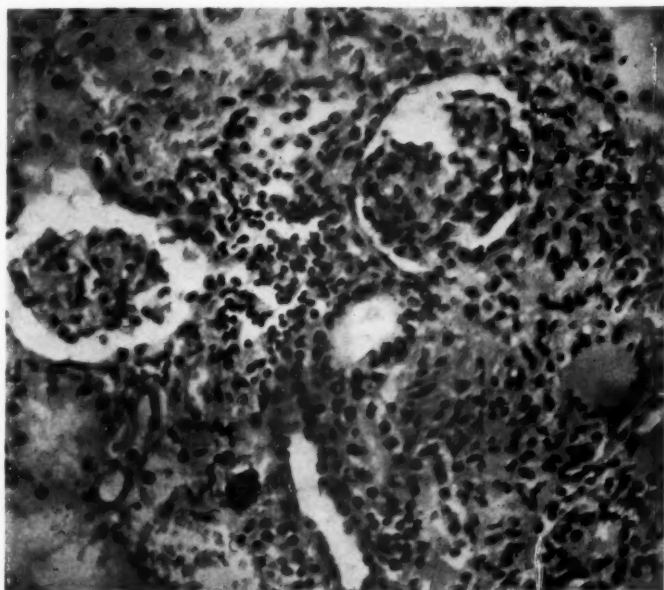


Fig. 11. Early renal tuberculosis with single giant cell in follicle; the lesion of parenchymatous disease before the onset of caseation and fibrosis ($\times 230$).



Fig. 12. Early lesion of lower calyx with tuberculous pyelitis and infection of the ureter. (Specimen from Institute of Urology, London.)

A lesion in the kidney discharging bacilli continuously or intermittently down the urinary tract is a menace to the patient because the bladder will in time become affected, the patient's symptoms be more severe and obstruction added to the other effects of tuberculosis ; thus destruction of the kidney is hastened. Besides, bladder contraction will obstruct the opposite and possibly normal kidney causing hydronephrosis and renal deterioration.

The risks of distant dissemination of disease are less than they were before chemotherapy ; formerly it was quite common to see patients develop joint lesions or meningitis or disease in the opposite kidney before

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they came fully under the influence of treatment. Nephrectomy, cystoscopy and pyelography were occasionally followed by severe and fatal dissemination of the disease.

The consequences of active tuberculosis in the kidney may be distinguished from the consequences of the healing process. Tuberculosis may heal with barely a scar in the renal parenchyma, but in the urinary channels healing is followed by fibrosis which ends in stenosis.

It seems therefore that there are two main aims to be kept in view when considering the technical aspects of the treatment of tuberculosis of the kidney and they are :

1. Elimination of the focus causing bacilluria, and
2. Prevention and relief of obstruction in the urinary passages.

Elimination of focus causing bacilluria

Since renal tuberculosis has a tendency to natural healing, bacilluria may cease under favourable circumstances with or without antibiotics. There is no doubt that, provided renal destruction has not gone too far, a combination of streptomycin, P.A.S. and isoniazid will sterilize the urine in the course of a few weeks, but the treatment must go on for several months or there will be a relapse. If, given adequate constitutional treatment and chemotherapy, tuberculous bacilluria does not markedly diminish or cease in the course of six to twelve weeks, or if progressive disease is developing in ureter or bladder, more active treatment is indicated. It is probable that the focus has become localised by fibrosis and that the antibiotic drugs can no longer effectively reach the bacilli. It is useless continuing intensive antibiotic therapy when all the soft and simple lesions have been cleared up and a hard encapsulated focus continues to discharge into the urinary tract. For this, active surgical treatment is needed and it should be undertaken when the patient's general resistance has been built up as far as possible, but not when the blood sedimentation rate is raised.

The most certain and oldest way of closing a discharging tuberculous focus in the kidney is by total nephrectomy including the ureter if it is diseased ; I believe this operation is still useful and should be carried out provided the opposite kidney is sound and free from disease and when the affected kidney seems to be undergoing progressive general deterioration despite full constitutional treatment and chemotherapy. Cases of total nephrectomy are among the most satisfactory of those treated by urologists in this branch of medicine.

For the more localised, and less destructive lesions in the kidney, conservative surgery has a very useful place, but the great difficulty is to decide accurately before operation the number and position of the lesions in the kidney ; in fact, at operation it may be almost impossible to determine how many lesions there are without incising the renal substance. For localised encapsulated lesions, few in number in the kidney, I have employed

curettage with excision of the fibrous wall of the lesions which peel out quite easily from the renal substance. This operation has on no occasion in my hands been followed by a fistula.

If the lesion appears to be more destructive with gross distortion of a calyx which has broken frankly into the pelvis causing an ulcero-cavernous lesion or if a part of the kidney is occupied by a tuberculoma or cavity, partial nephrectomy may be undertaken provided the rest of the kidney is reasonably free from disease so far as can be judged and that the operation can be done without disturbing the vascular supply of the rest of the kidney. Partial nephrectomy may be planned either according to the vascular tree of the kidney by ligaturing one of the arteries in the hilum and then seeing what amount of the kidney is deprived of its blood supply and excising that portion, or a wedge-shaped excision may be made and the kidney closed by suture. To discover the extent of, or the possible presence of other lesions in the kidney an exploring needle should be used or a small incision made into the cortex of the organ in suspicious areas.

Antibiotic treatment, and especially streptomycin, undoubtedly causes fibrosis when there has been more than minimal inflammation and tissue destruction; the drugs can also render the urine free of tubercle bacilli and heal renal lesions even in cases when some dilatation and distortion of the pelvis and calyces has developed, and the dilatation will diminish as the renal lesions clear up. This result is rather exceptional, however,

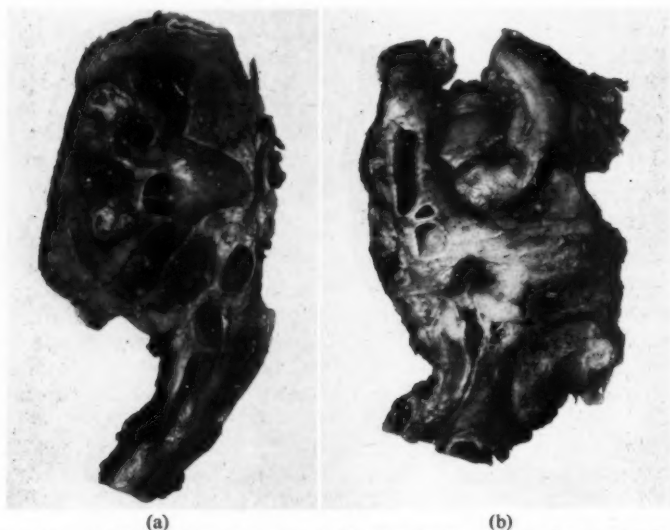


Fig. 13. (a) The kidney and upper half of ureter in a case of long standing obstruction due to tuberculosis of the bladder. (b) The contracted and grossly thickened bladder from the same case.

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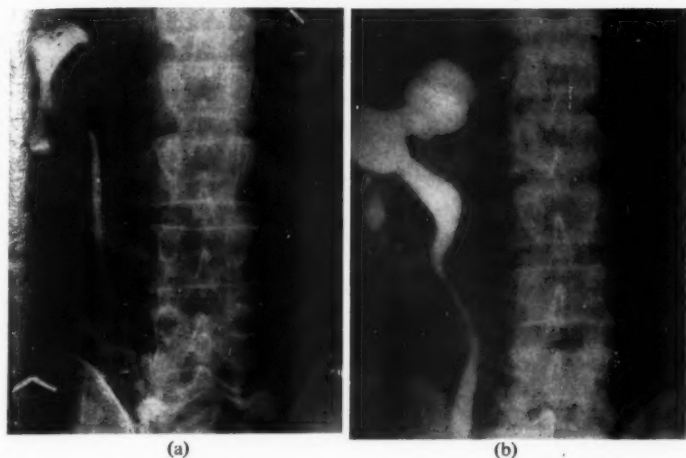


Fig. 14 (a) Ascending pyelogram immediately after removal of catheter showing stenosis in the pelvis of the kidney with dilatation of the calyces. This man of forty-four had a left nephrectomy for tuberculosis twelve years previously and his urine has remained free from tubercle bacilli for five years, during which time he has had sanatorium treatment and chemotherapy intermittently. (b) Ascending pyelogram after withdrawal of catheter showing stenosis of the ureter and of the infundibulum of the lower main calyx, from a man who had nephrectomy seven years previously and his urine, after sanatorium treatment and intensive chemotherapy, has remained free from tubercle bacilli. This kidney has probably no active tuberculosis in it but is suffering from the secondary effects of obstruction.

and the prevention and relief of obstruction remains a very important part of the treatment of urinary tuberculosis.

Obstruction quite often develops at the junction of calyces with the pelvis, or by contraction of the whole pelvis or more rarely at the pelvi-ureteric junction. In consequence one or more calyces may blow up or become cut off from the pelvis to form cystic spaces in the kidney. I do not know how to prevent or relieve calycal or pelvic obstruction and have two such cases under observation at present. Pelvi-ureteric obstruction is occasionally caused by a lower pole artery and has been treated by division of the artery and by a plastic operation on the pelvis, but in the latter operation there is great danger of fistula formation.

If renal failure is threatened by high obstruction in a solitary kidney, nephrostomy may offer the only chance of saving life, but, in my experience, nephrostomy for obstruction is always permanent for the infected ureter stenoses completely as soon as the urine stream is diverted.

A common site of obstruction is at the lower end of the ureter and is usually due to changes in the bladder wall, part of a generalised cystitis with reduced capacity. Occasionally, however, the ureter may be obstructed and the bladder free of disease.

In my experience dilatation of the intra-mural part of the ureter with bougies is very difficult and often impossible and, if successful, the benefits are short lived. If the bladder is not very thick and contracted, the ureter may be exposed outside the bladder, divided and transplanted to a new site making sure of a wide anastomosis. Such an operation relieves severe obstruction but is not usually followed by reduction in a pre-existing hydronephrosis, although function improves.

If the bladder is hopelessly contracted the ureter dilated and renal function failing, it may be necessary to decompress one or both kidneys as a matter of urgency, but usually there is time to consider whether some permanent improvement of the bladder function cannot be effected at the same time.

Urgent decompression can be by ureterostomy, but once the ureter has been divided and brought to the surface it cannot be reconnected with the bladder without the use of an ileal graft. Ureterostomy is occasionally very satisfactory and when well sited is easy to manage; unfortunately the ureter too often retracts within the abdominal wall, or undergoes terminal necrosis resulting in an unsatisfactory fistula.

In cases where there is progressive lower ureteric obstruction, and the renal infection is healed or subsiding satisfactorily and the bladder small but not ulcerated or otherwise actively tuberculous, an ileal graft may be employed to increase the bladder capacity and to receive the two obstructed ureters. A long stretch of ileum is connected to the bladder by a large anastomotic opening about its centre and the ureters joined to the loop at some convenient site near its ends. However, the substitution of ureter by ileum in this manner does not always achieve the expected results, nor does the use of an ileal loop simply to increase bladder capacity always prove a lasting success. The opening between the bladder and the ileal loop tends to contract and the loop becomes a diverticulum rather than an active part of the bladder. If ileum is used solely to increase bladder capacity, the loop should be widely opened and united to the bladder in as broad a union as possible to make a large patch rather than a cul-de-sac.

The contracted bladder remains one of the difficult problems in urinary tuberculosis which has always defied satisfactory treatment. During the active phase of tuberculous cystitis little can be done to prevent contraction or to ameliorate symptoms; dilatation with water pressure often repeated helps in only a few cases; suprapubic cystotomy invariably makes the patient more miserable. If the contraction cannot be overcome and the bladder holds only an ounce or so it should be abandoned and the ureter or ureters transplanted either to an ileal loop opening on the abdominal wall or to the sigmoid colon. The latter operation is less unpleasant for the average patient, but carries the risk of ascending infection and renal failure; this is serious in the solitary kidney. A possible solution is to transplant the ureters into the colon and to watch carefully by intravenous pyelograms and blood urea tests at regular intervals for evidence of

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renal deterioration. Should trouble develop and not clear up quickly, the ureters can be transferred to an ileal loop and drained to the surface in comparative safety.

SUMMARY

The treatment of urinary tuberculosis is basically the same as that of any other form of the disease, for it is the local manifestation of a general infection, of which there may be other foci, known or hidden. The basic principles are :

1. Constitutional treatment in proper surroundings with good food, fresh air, sunlight and rest.

2. The use of streptomycin, P.A.S. and isoniazid in combination until the urine has been free from tubercle bacilli by guinea pig test. These drugs may be used together or alternately in short courses and should be continued for between three months and two years depending on progress.

3. The elimination of bacilluria, which may be effected by constitutional treatment and chemotherapy alone, but may also require the excision of lesions in the kidney, part of the kidney or the whole of the kidney and ureter.

4. The prevention and relief of obstruction which may necessitate dilatation or excision of the ureteric orifice, operations on the pelvis of the kidney, nephrostomy or ureterostomy in the urgent case, transplantation of the ureters into the colon or an isolated loop of ileum or enlargement of the bladder by ileo-cystoplasty.

MONTHLY DINNERS

MONTHLY DINNERS ARE held in the College on the Wednesday before the second Thursday of each month. The following are entitled to attend with their guests : all diplomates and students of the College and members of the Associations linked to the College through the Joint Secretariat. It is not necessarily intended that guests should be members of the medical profession.

The next four dinners will be held at 7 for 7.30 on 12th February, 12th March, 16th April and 7th May.

The cost is £1 10s. 0d., which includes cocktails before dinner and wine at the table. Applications for tickets, accompanied by a cheque for the appropriate amount, must be sent to the Deputy Secretary at least a week before the date of the dinner. Cheques should be made payable to "Royal College of Surgeons of England." The dress is lounge suit.

OPERATIVE MANAGEMENT OF HAEMATEMESIS AND MELAEANA

With special reference to Bleeding from Oesophageal Varices

Lecture delivered at the Royal College of Surgeons of England

on
8th April 1957

by
Norman C. Tanner, M.D., F.R.C.S.

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Senior Surgeon, St. James' Hospital, Balham

THERE ARE FEW operations in gastro-enterology that present so many technical problems as the management of haematemesis and melaena. While nothing is quite so valuable as the experience gained in operating on or assisting at operations on such cases, many problems repeat themselves time and again, and much can be gained from discussing methods of avoiding, circumventing or overcoming various difficulties.

It is not intended to discuss anew the *indications* for operation and instead attention will be focused on methods of dealing with the situation, once the decision to operate has been made.

We may divide our cases broadly into three categories :

1. Cases with a past history suggesting peptic ulcer.
2. Cases with no past history suggestive of ulcer.
3. Cases of known or suspected portal hypertension.

GROUPS 1 AND 2, IN BOTH OF WHICH A PEPTIC ULCER IS THE LIKELIEST CAUSE OF BLEEDING

The first two groups can be considered together. Their main difference will be that with a good history of chronic peptic ulceration, surgery will be embarked on early. In cases where there is little or no ulcer history the decision to operate will usually only be made if there is a *severe* repetition of bleeding after the patient has come under treatment or if there is evidence of persistent bleeding. They have in common the fact that at operation particular attention will be paid to the stomach and duodenum, as being the likeliest source of origin of the bleeding. In patients with a history of oesophageal ulceration, truly massive bleeding rarely occurs except when the aorta or heart chambers are eroded and such cases rarely survive long enough to come to surgery. In cases with massive bleeding and oesophageal ulcer it is important to remember the frequent co-existence of oesophageal and duodenal or gastric ulceration, and in such cases a duodenal or gastric ulcer will not infrequently be found to be the site of the bleeding.

Pre-operative preparation

Occasionally the bleeding may be so uncontrollable, as for example when the splenic artery has been eroded, that the patient has to be sent to the operating theatre with no more preparation than the setting up of

one or more intravenous blood drips in order to maintain a sufficient blood pressure to move the patient to the theatre. It is doubtful whether intra-arterial transfusions have any very great advantages in such cases.

In the majority of cases each bleeding will be followed by a period of temporary arrest and improving condition. In such cases a few hours of slow drip transfusion is well worth-while, but undue delay is unwise as it may be followed by a recurrence of bleeding. The final stages of resuscitation are best carried out in the operating theatre ante-room.

After morphia has been given a catheter should be passed via the nares into the stomach in order to remove any excess of blood or gas. The tube will not remove blood clots, and the probable presence of clots in the stomach must be remembered by the anaesthetist, for at times blood and clot may be vomited and inhaled.

In patients with coincident ulcer perforation and bleeding there will be more urgency, but time should be taken to overcome pain and shock by the use of morphia, intravenous blood and plasma, and gastric aspiration. In cases with coincident duodenal or pyloric obstruction the stomach must be carefully decompressed and gently irrigated with a cold saline solution. The blood chloride and, if there is any suggestion of tetany, the calcium levels should be restored to normal prior to operation by intravenous saline infusion and calcium gluconate injections.

The anaesthetic

Either local or general or even in some cases a spinal anaesthetic may be used. General anaesthesia is most commonly favoured. The writer, however, uses local anaesthesia. It is possible to start the anaesthesia while the patient is still very ill, the dangers of blood inhalation are minimized and as many of the patients are elderly they are particularly suitable subjects for this form of anaesthesia. It is important to produce an efficient field block anaesthesia. Several of the modern local anaesthetic drugs can be relied upon to last two or more hours. Local anaesthesia is less well suited to the young, robust or obese.

The operative approach

A generous abdominal incision must be made, particularly when operating under local anaesthesia. It is however wise, if using local anaesthesia, not to extend the incision lower than the umbilicus, in order to prevent evisceration when the patient talks or coughs.

An upper abdominal incision is used. The writer makes a mid-line supra umbilical incision as high as the xiphoid process for most cases. If a deeply placed duodenal ulcer is present, particularly in an obese patient, there should be no hesitation in making a transverse extension of the incision into the right flank in order to obtain easy manipulation of the duodenum.

Rarely, extension of the incision by removal of the xiphoid process,

sternal splitting or extension into one of the left intercostal spaces may be required to deal with a high lying ulcer.

THE OPERATIVE MANAGEMENT OF THE BLEEDING LESION

On opening the abdomen, if local anaesthesia is used, a further injection of local anaesthetic solution is made. This may be made either directly into the splanchnic region, or into the tissues round the main vessels supplying the stomach near their origin, round the middle colic artery and into the upper jejunal mesentery near its attachment to the posterior parietes.

During the opening of the abdomen, excessive bleeding from the wound or the presence of enlarged veins in the ligamentum teres will be noted as indicating the possibility of portal hypertension. Additional evidence of hypertension may be given by the escape of ascitic fluid, by the appearance and texture of the liver and by splenomegaly.

The colon and upper jejunum should be inspected, sometimes blood in its lumen can be detected through the wall.

Whether there is evidence of portal hypertension or not, the stomach and duodenum are now carefully palpated and inspected. In some cases an ulcer will be immediately obvious, but even so the whole stomach and duodenum should be examined. The pyloric antrum and pylorus, and then the first part of the duodenum is palpated and inspected. Next a retractor is placed under the liver and the anterior surface of the upper stomach is examined, and then the oesophageal hiatus and any parts of the oesophagus which can be felt. If no definite ulcer or tumour is found an opening is made through the tenuous lesser omentum (hepato-gastric ligament) and the posterior wall of stomach and duodenum palpated, taking especial care to free any adhesion to the posterior wall of the upper stomach in order to examine this part fully. Both greater and lesser curve parts of the stomach must be studied, and then the stomach and duodenum rotated in order to *inspect* the posterior surfaces.

A small ulcer may be indicated by a local thickening or rigidity, perhaps with a tiny thickened vessel end in its middle feeling like a short bristle. It is very easy to overlook these minute evidences of ulcer. Local scarring, congestion, enlarged lymph nodes, failure of mucosa to slide over the muscularis, prestenotic diverticula are other evidences of the presence of ulcer. Soft adenomata may be almost indistinguishable from gastric folds. Leiomyomata are usually distinct enough not to be mistaken for blood clot and an ulcer may be felt in the leiomyoma. Most carcinomas of the stomach which present with massive bleeding are advanced, but occasionally they are small and may be difficult to distinguish from simple ulceration.

If this examination is negative then a careful examination of the rest of the abdominal viscera is to be carried out. The second and third part of the duodenum are examined for post bulbar ulcer, or carcinoma

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of the ampulla of Vater. If there has been a recent history of burns, a simple ulcer of the second part of the duodenum (Curling ulcer) or even in the jejunum may be found. The gall bladder is examined to see if it contains blood or a bleeding tumour and the branches of the coeliac artery are palpated for aneurysm. The pancreas is examined with care as either pancreatitis or pancreatic carcinoma are occasional causes of bleeding. The aorta is examined for aneurysm and calcification. In a recent case of the writer's the cause of repeated and finally fatal bleeding was a leak from a dissecting aortic aneurysm into a small opening in the third part of the duodenum (Fig. 1).

Next the jejunum, ileum and colon are palpated throughout their length and inspected where possible, looking particularly for the level at which intraluminal blood is present, for local or diffuse haemangiomas, simple or malignant tumours, inflammatory lesions and diverticula. Should a Meckel diverticulum be found it is examined for signs of ulceration in or near it. The ovaries and pelvic organs are examined for Krukenberg or other tumours.

If no adequate cause for the bleeding is found then re-examination of

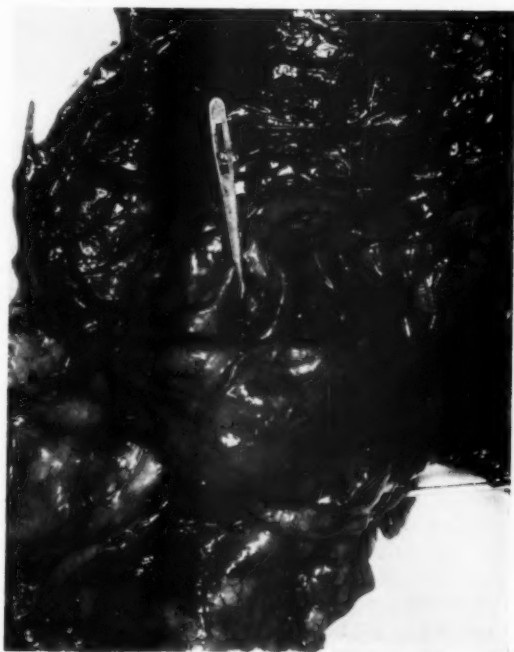


Fig. 1. A probe demonstrates a fistula leading from a dissecting aortic aneurysm into the third part of the duodenum.

the stomach and duodenum is made. If there had been a satisfactory pre-operative gastroscopy there will usually be no advantage in opening the stomach to inspect and palpate its interior, but if there is any doubt at all the interior should be examined. The pyloric region is one where small chronic ulcers can at times escape detection and so the gastrotomy



Fig. 2. A small ulcer with an open vessel end almost filling the crater. This gives the appearance of being an acute ulcer at operation, but in fact had an eight years' history.

should be a longitudinal incision extending from the pyloric antrum into the duodenum. This should be widely opened and the interior meticulously examined for scars, ulcers or gastric erosions. A finger should be passed up into the direction of the oesophagus and down into the second part of the duodenum.

If a *small acute* ulcer is found I am in favour of gastrectomy, preferably Billroth I, although there are some who advocate local resection for such lesions because of their lack of chronic symptoms and the possibility that this minor procedure may give subsequent long-standing relief. It is, however, not always certain that such lesions are solitary and some which appear acute may in reality be small chronic ulcers (Fig. 2).

If a chronic ulcer is found most authorities are now agreed that it is advisable to carry out a partial gastrectomy. Lesser operations have at times been advocated, e.g., local excision of gastric ulcers, or ligation of the bleeding point and gastro-jejunostomy for duodenal ulcer, but these have a lower success rate in stopping the bleeding and a higher

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change of recurrent bleeding than partial gastrectomy. However, such operations are certainly permissible if the surgeon feels that gastrectomy would be impracticable in his hands. The writer had carried out gastrojejunostomy and ligature of the bleeding point by duodenotomy ten times for severe bleeding duodenal ulcer up to ten years ago. Two patients bled again within a week and one died of haemorrhage, but eight did well.

The technical difficulties of resection, particularly of bleeding duodenal ulcer, may be extreme. Generally speaking, it is unwise to tackle these cases unless the surgeon has a wide experience of dealing with difficult duodenal ulcers. Occasionally the less experienced surgeon may be driven to operate on such cases, and under these circumstances palliative procedures, local excisions, sleeve resections, etc., will at times be the wiser choice. If a gastric ulcer penetrating the pancreas is the cause of bleeding, it is at times found that the splenic artery is eroded completely and bleeding may come freely from both exposed ends and both will need ligature.

The most difficult type of duodenal ulcer is the posterior ulcer penetrating the pancreas. The ulcer should be exposed by transecting the duodenum at ulcer level and then separating the posterior edges of the duodenum from the crater edge (Fig. 3). At times bleeding from a vessel in the crater is seen to be actively in progress making visualisation difficult. In such cases a strong small needle should be threaded with stout linen or silk and the bleeding point underrun without being over-concerned

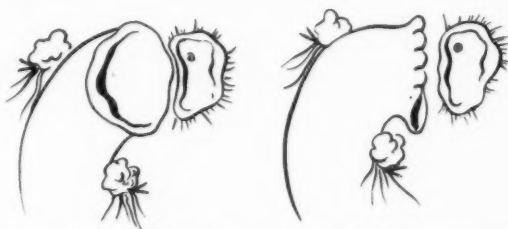


Fig. 3. A bleeding posterior duodenal ulcer. The duodenum is transected at ulcer level and then the posterior part of the duodenum is separated from the right edge of the ulcer by sharp dissection and the duodenum closed.

about the position of the pancreatic or bile ducts. These will in fact be but rarely encroached upon and too great a concern for them may lead to repeated inadequate attempts to stop the bleeding with consequent deterioration of the patient. It is at times easier to suture the ulcer edges together with or without a tampon of alginate gauze in the crater than to underrun the bleeding point. Should the bile duct have inadvertently been occluded by the suture it would be necessary to carry out a short circuit of the gall bladder to bowel during the convalescence, but in fact I have never seen such damage produced. It is however usually found, on exposing the ulcer crater, that bleeding is temporarily arrested and a

soft clot lies in some part of the crater. Full advantage of this desirable state of affairs should be taken. On no account should a swab or a sucker be placed near the clot, which may in fact be a loosely clotted aneurysm, for this may start off alarming bleeding. Instead the clotted area should be gently underrun with a strong ligature before proceeding further with the dissection.

The further duodenal dissection does not differ materially from that of non-bleeding ulcer. The main principle will be to dissect up a very short distance beyond the crater on the posterior wall—1 cm. is adequate,

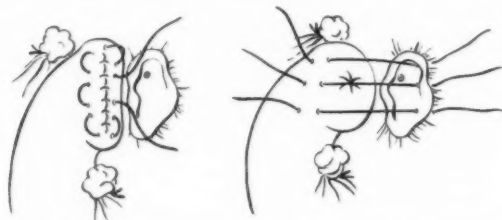


Fig. 4. If there is enough mobilized duodenum, a purse string suture is introduced, though there is often insufficient for this. In any case the closure is completed by suturing the left edge of the crater to the duodenum, thus reinforcing the suture line and burying the closed duodenal end in the ulcer crater.

and then suture the anterior and posterior walls together carefully. The suture line is, if possible, invaginated by a further suture line and finally a row of sutures is placed between the anterior duodenal wall and proximal or left edge of the ulcer crater so that the closed duodenal end is finally pressed snugly into the ulcer crater and on to the bleeding area (Fig. 4). A drain should be put down to the site of closure if there is any doubt at all as to its safety, or if there is any suspicion that the ulcer is deep enough to have eroded a pancreatic duct.

Post-bulbar ulcer

At times the ulcer will be in or involve the post-bulbar region and its base apparently overlying the bile duct. In such a case, if its probable difficulties are discovered before the duodenal dissection is begun, a palliative or pre-ulcer closure may be used. A catheter attached to a sucker is gently inserted into the duodenum via an opening made in the anterior gastric wall. If it is found that clear bile or duodenal juice is aspirated it can be assumed that bleeding is temporarily arrested. Under such circumstances a prepyloric division of the stomach, removing the antral mucosa, may be made (Tanner, 1951). Very rarely the first part or bulb of the duodenum is sufficiently unscarred to transect and close the duodenum proximal to the ulcer and distal to the pylorus. There is, of course, not quite the same certainty of preventing recurrent bleeding by this procedure. I believe that ulcer healing occurs very rapidly—in

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a matter of days after in most cases, but in one of my cases treated in this way recurrent bleeding occurred because, although the ulcer had practically healed, an aneurysm was present, which bled again on the seventh post-operative day (Tanner, 1954) (1).

Stomal ulcer

If a bleeding stomal ulcer is found, treatment may be varied. If the stomal ulcer follows posterior gastro-jejunostomy, the anastomosis may be dismantled and gastrectomy carried out, providing the patient is fit and the surgeon very experienced. Alternatively, the ulcer may be approached by anterior gastrotomy and the crater sutured over. Sometimes local excision of a jejunal ulcer is simpler. If the stomal ulcer follows a gastrectomy, local excision or suture of the crater, or a higher resection, may be required. If feasible a vagotomy should be added.

In the event of no likely cause for the bleeding being found, the surgeon is left in a quandary. In the past, either nothing has been done, or less radical measures used, e.g., tying the right and left gastric and right and left gastro-epiploic arteries, hoping thereby to reduce the gastric blood flow, at least temporarily. These measures may be followed by success in some cases, but if the bleeding is really severe, it continues or recurs after a short period in a high proportion of the cases. The late Professor H. Finsterer was a firm advocate of partial gastrectomy for these cases. The idea behind the gastrectomy is that there may be an impalpable bleeding lesion in the stomach or duodenum and an orthodox partial gastrectomy removes those parts of the stomach and duodenum most commonly affected by peptic ulceration. Even if the bleeding should have come from multiple gastric erosions the gastrectomy would probably remove many of them and would diminish the blood supply to the remaining part of the stomach. It is not uncommon after these "blind" operations to find the causative lesion in the excised stomach, a very gratifying confirmation of the correctness of the procedure.

As a result of the accumulated experience of such cases it is now generally conceded that a partial gastrectomy is the correct procedure, provided that the haemorrhage was "massive" and that a very careful examination of the abdominal viscera had failed to find any other causative lesion. This has been the writer's practice for some years and has proved a satisfactory one. Its failures have been, one case of diffuse erosive gastro-entero-colitis where bleeding continued from the colon, second was the case already mentioned where there was a fine fistulous communication between a dissecting aortic aneurysm and the third part of the duodenum, and the third a patient whose bleeding ulcer turned out to be 4cm. from the cardia on the greater curvature!

Persistence of bleeding despite gastrectomy

Despite gastrectomy bleeding may persist, particularly in cases where no causative lesion or a diffuse gastritic lesion was found. Patients

with haematemesis include a percentage of cases with defective power of blood clotting and so moderate degrees of suture line bleeding are commoner after gastrectomy for patients who have a history of recurrent haematemesis than in those with a history of pain only. Therefore the first treatment should be supportive and preferably the transfusion of fresh blood.

If bleeding persists to a dangerous extent despite this, it may be assumed that bleeding is taking place from the remaining stomach and that more active measures will be required. Theoretically a total gastrectomy will be required, but in view of the dangers and disability of this operation a "quasi-total" gastrectomy is preferable. This should be a resection of all but a cuff of stomach some 2cms. long round the cardia. By leaving this cuff the risks of the gastrectomy are reduced, probably to less than a quarter of the risk of total resection. The operation is easier, and in most patients can be carried out through an abdominal incision. In addition, the cardia mechanism is less disturbed than with a total gastrectomy and so biliary regurgitation is less likely to be troublesome later. It is probable too that even this small segment of stomach may be enough to delay the onset of macrocytic anaemia. This small segment of stomach will be highly unlikely to secrete enough digestive juice to lead to further ulceration. In one of the writer's cases this operation disclosed a bleeding lesion which had missed the previous resection, the ulcer being only 4cm. from the cardia on the greater curvature side.

Post-operative care

Patients operated on in a state of severe anaemia are more prone to post-operative infective complications than patients who are not anaemic. Therefore after operation slow drip transfusions should be given until a reasonable blood haemoglobin level is obtained, 65 per cent. at least. In addition it may be wise, particularly in elderly patients, to use an antibiotic prophylactically.

BLEEDING OESOPHAGEAL VARICES

In cases where oesophageal varices are bleeding, the lesion will usually have been suspected previously and treated by the use of an intragastric balloon. The inflated balloon is pulled against the cardia in order to compress the veins and so cut off the communication between the hypertensive portal veins and the oesophageal veins. The pressure in the oesophageal varices thus diminishes, so slowing the bleeding and favouring clotting.

On deflating or removing the balloon it is not uncommon for bleeding to recur, and the balloon may have to be reinflated. As a result of prolonged traction on the nasal catheter, local necrosis round the nares may occur. Liver failure is often precipitated by the anaemia and pneumonia from inhalation of blood by the debilitated and narcotised patient not infrequently leads to death. The writer's opinion is now that if bleeding

recurs when the balloon is deflated at the end of twenty-four hours' traction, then it should be reinflated and the patient prepared for urgent operation.

The nature of the operation

For many years there has been considerable thought and experiment to try and find an operation which would arrest bleeding from oesophageal varices. The older operations of splenectomy, tying the splenic and left gastric arteries, or ligation of the left gastric vein are rarely followed by success. Direct attacks on the veins by injecting the varices with sclerosing solutions is obviously unsuitable during the acute phase of bleeding. Even as an interval operation the writer found the procedure disappointing in a trial of several cases some fifteen years ago, though a few encouraging reports have been made. The swallowing of anticoagulants, buffered thrombin, gelfoam, etc., is not of help.

Pemister recommended resection of a length of the oesophagus and cardia as a means of arresting bleeding from varices. This is a somewhat formidable procedure, but it has been followed by a good measure of success, which in many cases is longlasting.

In 1950 the writer made a more direct attack on the varices as an interval operation. A longitudinal incision was made through the muscularis of the lowest oesophagus and then a running suture of catgut was passed all round the circumference of the mucosa (after separating it from the muscular layer). As this was followed by another haemorrhage two months later the procedure was not used again.

A similar method is used by I. Boerema (1949) and G. Crile, Jr. (1953), who sew up the lowest varices rather as they would treat piles. Using a transthoracic approach through the eighth rib bed, an incision one inch long is made into the oesophagus, two inches above the cardia. On holding the gullet open three groups of varices are seen which project into the stomach. Each varix is obliterated by a running suture, and Crile recommends that the suture be continued down until gastric mucosa is reached and as high in the gullet as can be reached through the incision. This method is effective for acute bleeding and has the advantage of having a much lower mortality than oesophago-gastric resection. On the other hand, in cirrhotic cases its effect appears to be only temporary, for R. R. Linton (1953) found that bleeding recurred in five out of fourteen Boerema-Crile operations between two weeks and five months after operation. It is remarkable how readily hypertension in varices recurs if any vascular connexion remains between the portal and azygos veins and so this operation, which leaves many minor oesophageal veins untouched, will have only a temporary effect, but it is useful as an emergency procedure.

The writer has always aimed at achieving a method of dealing with the varices locally which would not only arrest acute bleeding but also have some success in preventing later bleeding. An operation of this sort is

particularly desirable for the patient who is unsuited for any form of porto-caval venous shunt, e.g., the so-called post-splenectomy bleeder who has no satisfactory portal vein.

I have always been attracted by the idea of making a complete surgical division between the veins of the portal and of the azygos systems below the cardia, in order to reduce the pressure in the oesophageal varices to that of the azygos vein. I first used the operation which I called trans-gastric porto-azygos disconnexion, in which the mid stomach is transected and resutured, after having divided all the vasa brevia and the branches of the left gastric vein which drain the stomach above the line of transection (Tanner, 1950).

Unfortunately, some three or four of the cases eventually bled again. It was found by post-mortem injection methods that there was no appreciable flow across the gastric suture line eighteen months after transection and resuture, but venous connexions between the oesophageal veins and inferior phrenic veins around the cardia kept the pressure up in the varices, presumably because the inferior phrenic veins had become hypertensive. Therefore I modified the operation and since 1951 have carried out what is now a *subcardiac* porto-azygos interruption as follows (Tanner 1954) (2).

By an abdomino-thoracic approach the lower 5cm. of the oesophagus, the cardia, the upper 5cm. of greater and lesser curve of the stomach are



Fig. 5. Diagram showing the method of cutting all venous communications between the oesophageal veins and the portal branches.

entirely freed from all external vascular connexions. The stomach is then completely transected 5cm. below the cardia and firmly resutured. (Figs. 5 and 6). There is just enough blood supply from the oesophagus

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to nourish the small upper gastric segment. This operation has effected a considerable improvement in our results in cases of persistent or catastrophic acute bleeding. It has also proved a valuable interval operation.

In all, some eleven cases of acutely bleeding oesophageal varices have been treated by this procedure with cessation of bleeding in each case. Some months later minor bleeding occurred in two cases and a fatal one

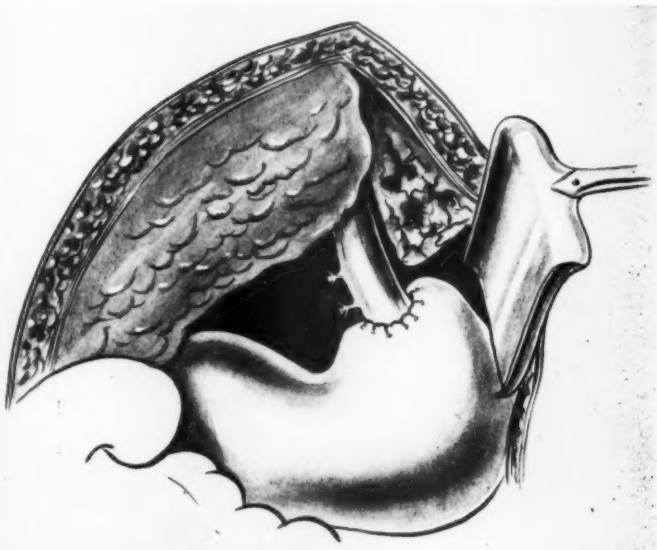


Fig. 6. At the completion of the operation most of the small upper segment of stomach is hidden by the wide Lembert stitching.

in a third. This latter was due to a gastric ulcer which had appeared at the suture line. Against my usual practice I had made the anastomosis with silk. Since using catgut for this layer, no further suture line ulcers have been encountered.

In addition, the operation has been used as an interval operation on many cases with excellent long term effects.

The operation may be followed by some degree of post-vagotomy gastric stasis, and a pyloroplasty had to be carried out subsequently in two cases to correct this. In the rest of the cases a few days' gastric suction has been sufficient to avoid any serious post-vagotomy complications.

It might be expected that ascites might follow the severance of several large venous anastomotic channels. In fact there has been only a minor

difficulty in two cases. It has been no more common than after porto-caval anastomosis where it may appear as a transient complication.

A shunting operation between the portal and caval systems is a most valuable interval operation for oesophageal varices, but has the undoubted drawback that a certain number of the cases suffer severely from cerebral symptoms as a result of the by-passing of the liver by nitrogenous material from the bowel. It has only rarely been tried as a method of treatment during the acute phase of bleeding. The only large series of such cases known to the writer is that of W. D. O'Sullivan and M. A. Payne (1956) who carried out an emergency porto-caval shunt on nine patients. Three patients died in a post-operative phase, one of unremitting haemorrhage. Of the six survivors, three had since died, two of homologous serum jaundice, but none of the survivors had bled again.

Hepatic artery ligation has a very doubtful place in the treatment of portal hypertension. It has been used as an interval operation for acutely bleeding oesophageal varices, but W. A. Altmeier and his associates (1955) found recurrent bleeding in six out of eighteen cases in which it was tried. Two died of the operation, five more died within five and a half months and two died of recurrent bleeding. Their experience would suggest that there is no place for hepatic artery ligation in the treatment of bleeding oesophageal varices.

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CYTOLOGICAL INVESTIGATIONS WITH THE ELECTRON MICROSCOPE

Arris and Gale Lecture delivered at the Royal College of Surgeons of England
on
3rd January 1957
by

G. W. Causey, F.R.C.S.

Sir William Collins Professor of Human and Comparative Anatomy,
Royal College of Surgeons of England

A LITTLE MORE than 300 years ago Edward Arris and John Gale each gave a sum of money to the Barber-Surgeons Company for the foundation of a lecture on an anatomical subject. This commemoration lecture is concerned with electron microscopy in relationship to the study of the morphology of cells. Is there any direct relationship between these two actively minded men and our subject to-day? What would be their reaction to the developments of the microscope that have gone on in the 300 years that have intervened since the inception of these lectures? I think they would have been fascinated by the ever increasing resolution that has led to the possibility of investigating the structure of the animal body at the macro-molecular level.

In Raymond Crawford's book on "The last days of Charles II" is a picture of Edward Arris with Sir Charles Scarborough who was physician to Charles II and also a foundation member of the Royal Society. Now these two gentlemen were close friends, and one cannot help but speculate as to whether, at some evening soiree at the Royal Society, Edward Arris, as a guest of Sir Charles Scarborough, went to see the remarkable structures demonstrated by the Secretary of the Royal Society, at that time Robert Hooke. Robert Hooke published his *Micrographia* in 1665 and one must assume that he had been working with his simple microscope for some years prior to this date, and satisfying the intellectual appetite of the Fellows of the Society with demonstrations of the remarkable things that could be seen with this then remarkable, and now primitive, piece of apparatus.

The electron microscope is a direct development from the optical microscope as used by Robert Hooke. Nearly 200 years passed before the introduction and completion of the modern microscope with Abbe condenser and compound optical system, and by this time the light microscope was reaching the limits of its theoretical possibilities with regard to the basic requirement of resolution. The ultimate resolution of the light microscope is dependent on the wave length of the incident light. The mean wave length of visible light is in the region of 5,500 Å units, (1 Å unit is 10/millionth of a mm.) and the maximum resolving power that can be expected with such light is in the region of half of this mean wave length. There are ways of improving this resolution of which possibly the most important is the use of ultra violet light, with a mean

wave length of 2,000 Å units, and by the end of the nineteenth century these theoretical limits were being reached and used in biological research.

At this same period, in 1897, Lord Rutherford demonstrated the existence of the electron and the possibility of an electron beam, with an equivalent wave length of the order of $1/20$ th of an Å unit and certain physical properties similar to those of a wave of visible light, which can, if suitably controlled, greatly increase the resolving power of a microscope. But it was not until 1926 that this speculation became a practical possibility. In that year Busch (1926) showed that magnetic fields could be so arranged and controlled as to produce the same effects on an electron beam as do glass lenses on a light beam. The same results using electrostatic fields were obtained nearly ten years later by Brüche and Johansson (1932) and with this substantiation of the theoretical background the construction of electron microscopes began.

There are now many electron microscopes produced throughout the world, but the detailed differences in performance and construction of these need not concern us, however, the general principle of the lens system and electron path is shown in Figure 1. The tungsten filament which provides the source of the electron beam is seen on the right and there are indicated three sets of lenses. These correspond to the three systems of lenses used in the optical microscope. The one nearest the tungsten filament is the condenser lens and the object to be examined is marked in the diagram on the specimen plane between this condenser lens and the objective lens (L_o). The lens to the left, labelled (L_p) is the projector lens

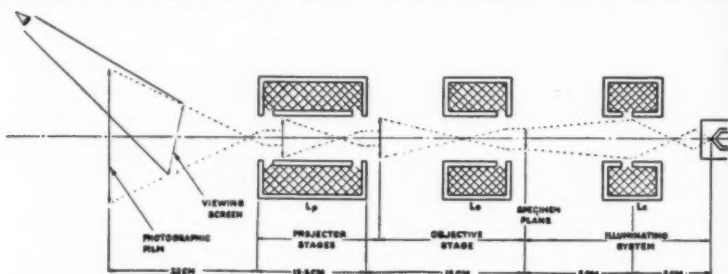


Fig. 1. Diagrammatic representation of the electron path in an electron microscope.

or eyepiece and from this lens the electron beam is passed to the fluorescent screen for immediate visual examination or on to a photographic plate for recording and examination. One must mention that this electron beam must be in a high vacuum with a pressure of, at most, 10^{-4} mm. mercury, and that the smallest deviation in the turning of the metal core of the magnetic lenses, even to flaws and minor impurities in the actual metal itself, have marked effects on the usefulness of these lenses. Also the

smallest fluctuation in the current fed to the windings of these lenses will again produce a distortion grossly magnified in the final picture. It is the control of the vacuum and the stabilisation of the voltage that play a very large part in the complexity of the machine.

The major interest of these machines to us is as a tool in medical research and possibly in the near future in medical diagnosis. Before we can go on to consider some aspects of cell morphology and variations therein under experimental conditions we must consider, very briefly, the preparation of the specimen. It has already been shown that the specimen has to be introduced into a region of very high vacuum and the working out of a system of copper grids, formvar or carbon films, and methacrylate embedding of specimens, which is now fairly universal, took many years of careful work and thought to produce. I shall only discuss biological material—(although one must bear in mind that some of the major advances and most practical uses to which this machine has been put are in fact in the fields of metallurgy.) In the early days of examination of biological material much of the examination was confined to fragmented and centrifuged tissue or small particles of bacterial or virus size. It was, however, quickly seen that even these small specimens were too thick for the best resolution of this machine to be obtained and therefore an era began in which microtomes were developed to cut thinner and thinner sections.

Modifications of existing microtomes began in about 1940 when Pease and Baker reduced the angle on a Spencer microtome and Bretschneider adapted the Cambridge rocker microtome for thinner sections. There are now several microtomes on the market or made in different laboratories, such as the Porter-Blum and Leitz and the Cook and Perkins. In the Cook and Perkins model there is a quadrangular circuit of the specimen so as to get contact with the knife on the down stroke only. The advance of the specimens depends on the thermal expansion of the rod on which it is carried and therefore the thickness of the specimen will be proportionate to the rate of traverse and current passed through the winding. Glass or diamond knives are used and sections of from 300 to 100 Å units thickness can be obtained.

Having set the background by this short description of the apparatus used, I should like to go on to discuss some of the work that has been carried out in the Royal College of Surgeons with this type of apparatus.

In the hands of such masters of neurohistology as Ranvier, Retzius and Cajal the optical microscope has given us a very clear picture of the structure of a peripheral nerve in transverse section. One of the first points of note in the electron microscopy of such structures is how well and easily it vindicates both the observations and deductions of these masters.

Figure 2 shows a low power electron micrograph, from the vagus nerve of the rabbit. The vagus nerve has been used so as to show plenty of

non-myelinated fibres. The first point that strikes one is the presence of Schwann protoplasm visible in a very thin layer around these myelinated fibres, according to the classical description. In the left hand corner a fibre is cut in the region of the nucleus of the Schwann cell where the cytoplasm is abundant. In between the myelinated fibres are bundles of non-myelinated fibres, one or two together or ten to fourteen non-

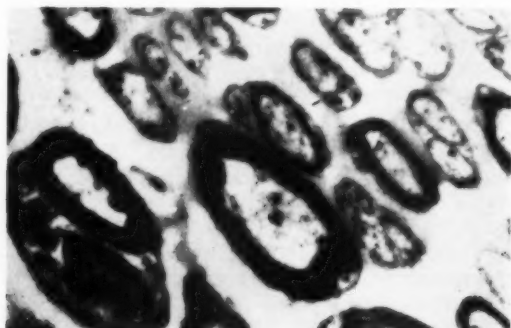


Fig. 2. Electron micrograph of fibres from the vagus nerve of the rabbit showing myelinated and non-myelinated fibres. X 5,000.

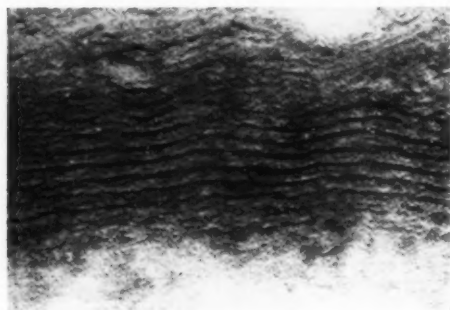


Fig. 3. A portion of the myelin sheath of a nerve fibre showing the regularly spaced myelin lamellae. X 130,000.

myelinated fibres, but always surrounded by Schwann cytoplasm. I shall return again later to the relationship of this Schwann cytoplasm to the non-myelinated fibres.

Figure 3 shows the myelin itself at high magnification in an osmic fixed preparation, lipid lamellae can be seen in the myelin sheath. The distance between two contiguous lamellae is about $140/10$ millionths of a millimetre and even in this extraordinarily small distance, which represents no more than 100 to 200 hydrogen atoms strung together, there is an

intermediate line of less dense material between two lines of more dense material. It is interesting to note that this structure of myelin had been deduced by Schmitt and Bear (1937) and others from diffraction studies and polarization light studies long before the electron microscope, and the amazing thing is that the careful study of the spacing of these lamella, made by Fernandez-Moran (1950) in the electron microscope, agrees so completely and accurately with the deductions of Schmitt and Bear.

We have been interested particularly in the effects of experimental interference with peripheral nerves on the electron microscopic picture. It was established by Hoffman (1950), Edds (1950), and van Harreveld (1952), that if a muscle is partially denervated, that is, if one of the branches of a nerve which splits into two before it enters the muscle, is cut, then the intact fibres in the uncut branch will sprout and send fibres that reinnervate the motor end-plates degenerated by cutting the other motor nerve. We did not know whether a similar process could occur in the nerve trunk and in fact Edds came to the conclusion from optical studies that no new branching occurred within the nerve trunks themselves. Partial denervation of the muscle was produced in the way already described and also partial deneurotisation of the nerve. This term requires some explanation. The sciatic nerve of a rat contains components from the fourth, fifth and sixth lumbar segments. Now if the fifth lumbar root is cut before it has joined the fourth and sixth to form a definitive sciatic nerve this produces degeneration of some of the fibres in the tibial nerve of the rat, but leaves others in their normal condition.

The small non-myelinated fibres in the vagus nerve are illustrated in Figure 2. In a normal tibial nerve there are practically none of these fibres. There are so few that they are difficult to demonstrate pictorially in an electron micrograph, but after a partial deneurotisation one gets a picture similar to that of the vagus nerve in Figure 2. Instead of an absence of non-myelinated fibres there are clumps of non-myelinated fibres within the cytoplasm of the Schwann cells. These groups of non-myelinated small fibres are very numerous in sections taken from the tibial nerve in the leg after cutting the fifth lumbar nerve close to the vertebral column. It would take three weeks, or more, for fibres to cover the distance from the vertebral column to the level of the tibial nerve from which these sections were taken, so that the large bunches of small new fibres must have come from the remaining normal fibres of the tibial part of this partially deneurotised nerve. In fact, there is really no possibility of these having come down from the cut fifth root, because it can be shown that many of these small new fibres are present forty-eight hours after nerve section, and in four to seven days they are widely scattered throughout the nerve trunk. There is substantial evidence to show that these fibres are in fact sprouts from the region of the nodes of Ranvier from the remaining normal fibres in partially deneurotised nerves.

Has this phenomenon of sprouting in partially deneurotised nerves any more clinical application? The effects produced by poliomyelitis on

the tibial nerve: destruction of the anterior horn cell with the resulting degeneration of the motor nerve fibres, are very similar to the effects produced by partial deneurotisation of this nerve. The destruction of the anterior horn cells by the virus is limited to a proportion of these cells. It would, therefore, be expected that in a peripheral nerve, such as the tibial, there would be degenerating fibres resulting from the destruction of some of the anterior horn cells together with normal fibres from the non-infected anterior horn cells. The question at once springs to one's mind—do these normal fibres remaining in the tibial nerve also produce sprouts? This possibility has been examined in mice infected with the Theiler encephalitis virus (material kindly supplied to us by Professor Wohlfart of Lund), and we find, seven days after the onset of paralysis, that there are small non-myelinated fibres surrounded by Schwann cell cytoplasm, in fact, the picture is exactly similar to that of the tibial nerve of a rat after partial deneurotisation.

Let us now turn to another problem in morphology that has arisen from the electron microscopic examination of nerves. Returning to the section of non-myelinated fibres in the vagus nerve as shown in Figure 2, it can be seen that there are connections between the surface of the Schwann cell and the double membrane of the nerve fibre. These have been called by some the surface connecting membranes, but I think the term proposed by Gasser in 1955 is an adequate and descriptive one and I shall adopt this term—mesaxon. Taking some single fibres inside their cytoplasm as in Figure 2 it can be seen that these mesaxons are quite well marked on two of the fibres. Of the four fibres in the centre—the one to the right and the third from the right both show a connection of axonal covering in the Schwann surface. This relationship is not confined to any single nerve and in Figure 4 there is an interesting collection of axons from the dorsal root of the rat. This picture brings out two points—on the right hand side there is an axon which is dipping into, or causing a depression in the surface of the Schwann cell, but it does not seem as yet to have formed a complete mesaxon. Whereas on the other side of the bundle there is a well formed mesaxon of quite considerable length coming from the Schwann cell surface to the nerve fibre. The same sort of configuration is seen in regenerating nerves, and the small sprouts, which are formed after partial deneurotisation of the tibial nerve, have an appearance as though new formed axon sprouts were being enveloped by the Schwann cells that have been activated by the section of the nerve. Figure 5 shows a rather chance section that in fact comes from another part of the body, but shows rather dramatically, the type of amoeboid activity which these Schwann cells seem to have when they are stimulated by trauma and in this picture one can visualize a process of the Schwann cell like the pseudopod of an amoeba wrapping itself round the young nerve fibre.

Geren (1954) has been into this same problem in the developing nerves of the chick and has shown similar relations of the Schwann cell to the developing nerve fibre in the early chick embryo. It is suggested that this

CYTOLOGICAL INVESTIGATIONS WITH THE ELECTRON MICROSCOPE

double layer formed by the mesaxon can, by continued rotation of the Schwann cell around the axon, produce layer after layer of lamellae, which may be the ultimate origin of the lamellation of the myelinated sheath of a myelinated nerve fibre.

I should like now to pass more centrally and look at the structure of the dorsal root ganglion. An optical picture of a normal dorsal root ganglion,

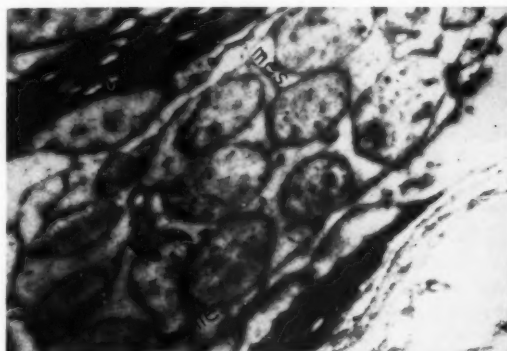


Fig. 4. Small, non-myelinated fibres in the dorsal root (rat), showing invagination of the fibres into the Schwann cytoplasm (mes). X 5,000.

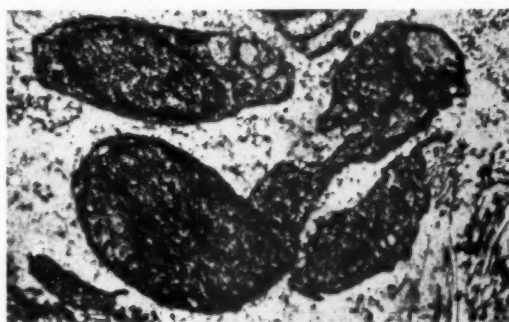
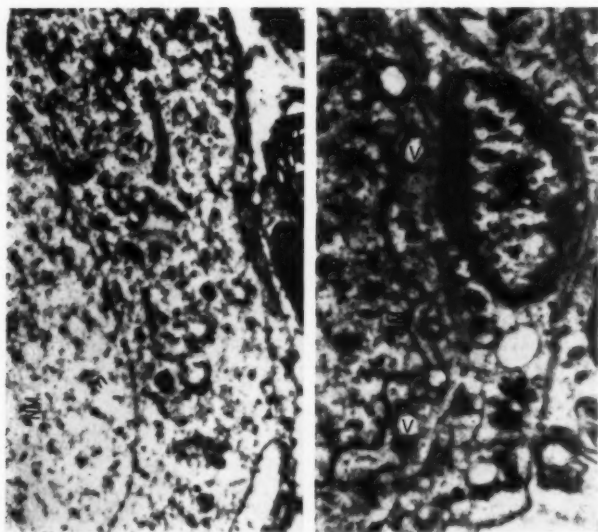


Fig. 5. A Schwann cell showing amoeboid activity after a section of a nerve. The cytoplasm of the cell appears to be engulfing the nerve fibre in the upper right hand corner. X 5,000.

stained by the Nissl method shows the usual histological characteristics, the large nucleus with the well-marked nucleolus and the basophilic cytoplasm with the granular staining of the Nissl substance. The amount and distribution of Nissl substance in normal ganglia varies considerably from cell to cell and in some is in large aggregates—but in others is uniformly distributed throughout the cell.

Coming now to an electron micrograph of a normal ganglion we see on the left of Figure 6 the smooth surface of the nucleus marked out by the nuclear membrane, and then the cytoplasm with its various inclusions of which the most prominent are the elongated mitochondria. The right margin of the cytoplasm is limited by the cell membrane and to the right of this membrane is a thin layer of the cytoplasm of the supporting or satellite cell. On the extreme right of this illustration, lying between the contiguous neurons with their satellite cells is a portion of a myelinated nerve fibre with Schwann cell nucleus and enveloping Schwann cytoplasm. Our interest in these dorsal root ganglion cells has really been concerned with what happens to the cellular structure when the axons which proceed from these cells are cut. We have divided the lumbar roots and removed the dorsal root ganglia corresponding to the cut roots at various times from forty-eight hours to three or four weeks after the section of the root. In other words, we have examined these dorsal root ganglion cells at all sorts of stages in what is known as the chromatolytic cycle. This is a very complicated process which includes first of all the lytic phase, in which the stainability of the cytoplasm with cresyl violet or methylene blue diminishes and then the synthetic stage in which the basophilic components of the cell are reconstituted and take up the dyes once again. The optical



Figs. 6 and 7. Fig. 6. Part of the nucleus and adjoining cytoplasm of a normal dorsal root ganglion showing the smooth nuclear membrane (*NM*) and elongated mitochondria (*m*). Fig. 7. A similar cell sixteen days after section of its emergent nerve fibre. The nuclear membrane (*NM*) appears activated and the mitochondria are replaced by vesicles (*v*). Both approximately X 20,000.

picture during this cycle has been carefully studied and illustrated by Bodian (1947) and his school. However, there are two points that I should like to discuss because they illustrate rather clearly and dramatically the possible value of the high resolving power of this technique.

After studying many of these ganglion cells that had had their axons removed at different times prior to examination we were forced to the conclusion that the overall picture is made difficult of interpretation by two facts—first that the chromatolytic part of the cycle and the chromosynthetic part of the cycle may be occurring in different parts of the same cell at the same time, and certainly are at different stages in different cells of the same ganglion at the same time, and secondly that as one might expect even in, what must for the lack of a better term be called the "normal" dorsal root ganglion, synthetic and lytic processes are going on.

It is sometimes difficult to remember in looking at the static pictures of histological material that these are simply single experiences in a continuous dynamic process and that one would expect, in the living and active animal, that there would be quite appreciable differences between the phases of metabolic activity in different cells of the same ganglion of the "normal" dorsal root ganglion.

However, with all these provisos we were satisfied with the validity of the appearances that are shown in Figure 7. This illustration shows the nucleus and part of the cytoplasm of a dorsal root ganglion cell sixteen days after nerve root section, and if it is compared with the normal cell in Figure 6 there are two striking points in this chromosynthetic cell. First, the appearance of activity of the nuclear membrane and secondly, the vesicles replacing the mitochondria in the cytoplasm. It seems probable that in these highly active cells, which are in the process of rebuilding and reconstituting their axons, there is intense activity at the nuclear membrane surface and in contact with this surface there are vesicular bodies, which are possibly forerunners of new mitochondria.

Figure 8 shows a small area of the nuclear membrane from such a cell at much higher magnification and it is very striking to see the finger-like process on this nucleus such as is seen at the top, with two aggregations of electron dense material at the base of the hillock and three vesicles forming a chain from the apex of the process. Under the upper projection there seems to be still continuity between the small vesicle and apex of another of these projections from the nuclear surface.

I have ranged over several experimental fields to try to indicate some of the problems that have interested us. I must, however, introduce one further region on which information is rapidly coming together. In the superior cervical ganglion we see again the cell outline, the nuclear membrane and cytoplasmic inclusions of a similar sort as those that have been demonstrated in the dorsal root ganglion, but of course there is an essential difference in these two structures in that, in the superior cervical

ganglion we should expect to find regions of synaptic continuity that are not present in the dorsal root ganglion. Figure 9 shows a typical synaptic ending. The small nerve fibre is included in the cytoplasm of the supporting cell and here it is immediately apparent that this cytoplasm could be equally well called the cytoplasm of the Schwann cell in relation to these fibres or the cytoplasm of the satellite or supporting cell in relation to the neuron. It is in the relationship between these small nerve fibres and the surface of the cell that we must look for the axosomatic synapse.

I have taken these examples of electron micrography from several parts of the nervous system and under varied experimental conditions to show something of what I believe to be one of the big modern developments of

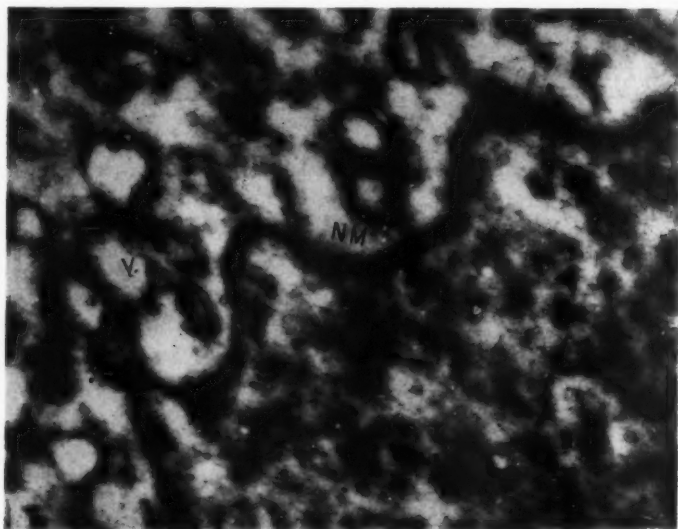


Fig. 8. Vesicles (*v*) in relation to the promontories of an activated nuclear membrane (*NM*). X 55,000.

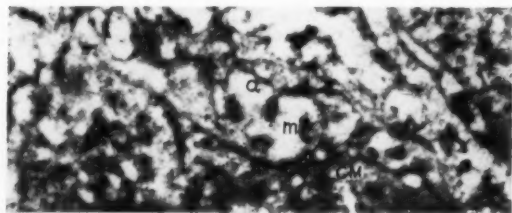


Fig. 9. A small nerve fibre (*a*) with four mitochondria (*m*) forming a synaptic termination on the nerve cell membrane (*CM*). X 15,000.

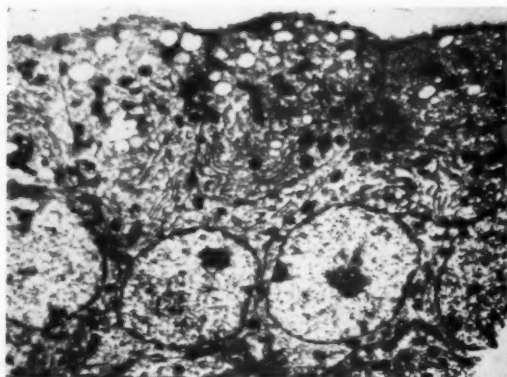


Fig. 10. Four prostatic epithelial cells. X 3,000.

microscopy. The functional organisation of these intracellular structures will take years of experimental and observational work to elucidate, and particularly when we consider that each cell that we look at in this way has perhaps all these identifiable intracellular organisations whose relations to the biochemistry of the cell must be elucidated. For instance, Figure 10 shows a completely different region, part of the epithelium of the prostate gland. Here again we see mitochondria, cytoplasmic inclusions and nuclei with evidence of the endoplasmic reticulum consisting of parallel electron dense laminae, all of which must presumably change or take part in functional changes in these cells.

I think Edward Arris, and I hope also John Gale, would have been excited and stimulated, as we are, by these recent adventures into intracellular structure, demonstrated by the greater resolving power of this tool that is the direct development of Robert Hooke's microscope.

ACKNOWLEDGMENTS

I wish to acknowledge the contribution of Dr. Hoffman and Dr. Barton to this work; the technical assistance of Mr. Edwards and the financial support of the British Empire Cancer Campaign.

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SIR SIMON MARKS

Honorary Fellow of the Royal College of Surgeons

A Great Benefactor

THERE MUST BE few who live their lives without some personal contact with a surgeon. There are many who gratefully acknowledge how much they owe to surgical care and skill though few do it practically. Everyone would admit, however, that it is better to have a good surgeon than a poor one, but not everyone knows how much time and money it takes to produce Lister's kind of surgeon who understood fully that "to



intrude an unskilled hand to such a divine mechanism as the human body is indeed a fearful responsibility." Surgeons on the whole are modest men who have been slow to inform the public about what they do. Thus the work of the College is comparatively unknown to the public. Surgeons themselves should know that the work of rebuilding what was destroyed on the night of May 10-11 1941 and of fulfilling the vision of Alfred Webb-Johnson has been tirelessly pursued since that catastrophe and is to-day more than half completed. They will know too

SIR SIMON MARKS

that in the early part of this year the shortfall in the Restoration Fund, after completion of Phases I and II and the expenditure of over £1,000,000, was still £500,000 together with additional future maintenance costs of £150,000 per year.

Faced with this grave situation Council made an appeal to an already generous member of the Court of Patrons. The exchange of letters between the President and Sir Simon Marks is of such a kind as to be worthy of record.

30th August 1957.

DEAR SIR SIMON,

As a Member of the Court of Patrons I am addressing this letter to you in the belief that you will be sympathetic to the present needs of the Royal College. Your past great benefaction to it and your present interest in the serious situation in which we now find ourselves concerning our rebuilding problem emboldens me to ask you whether you might be prepared to assist us once more.

As you know, we have had to order the cessation of building as from September 30th owing to the fact that our financial resources are exhausted. Thus the ship is aground and, at the moment, there seems no possibility of refloating it.

The immediate need is to complete the building known as Phase IIIa which will house research laboratories and lecture rooms. These are urgently necessary to round off Phases I and II which are now in operation. The cost will be about £250,000.

The matter is of grave importance, for the College is a national asset bound intimately with the future of surgery not only in Great Britain but in the Commonwealth itself.

In order to complete the entire rebuilding of the College as planned, it is estimated that a further sum of £250,000 will be necessary. The Royal College of Surgeons will then be linked with the laboratories of the Imperial Cancer Research Fund and to the new College of General Practitioners, both of which are being built alongside our own College.

The profound influence which this unique combination of minds and knowledge will have upon teaching and research in medicine cannot be sufficiently stressed. Closer collaboration of all branches of medicine will thus become possible, with the Royal College as a more effective centre. In order to take full advantage of these developments we will need a further annual sum of £150,000 to finance the essential functions of operating the College more in conformity with its high task and duties towards humanity. (Our present annual income is £100,000.)

I need hardly say that if you were to take an active part in refloating our ship you would earn the gratitude of the Royal College and of all present and future Members of our great profession.

Yours sincerely,
JAMES PATERSON ROSS,
President.

17th September 1957.

DEAR SIR JAMES,

I am honoured by your invitation of August 30th to assist you and your colleagues in the re-building problems of the Royal College of Surgeons which have been brought about by lack of funds. You ask me, as a member of the

SIR SIMON MARKS

Court of Patrons, to take an active part in refloating your ship. I regard it as a privilege to comply with your wishes to the best of my ability.

The cessation of your building activities would have been a lamentable setback to your high hopes for the future of the College and its position in the world of medicine. The progress of surgery must depend on the continuity of fundamental research in ever increasing measure, and the teaching of those men who will be capable of carrying on the centuries old tradition of your world renowned College.

I am glad to have made it possible for you to continue the building of the phase of your plans known as IIIa. This will give you the opportunity of attaining some of the aims and objectives which you and your colleagues have so much at heart.

We laymen must be grateful to you for your dedicated work in the universal struggle against disease. If we in this country are to remain in the forefront of medical progress it is incumbent upon men of sympathetic understanding to support you in your high task and duties towards humanity.

I am obliged to Sir Archibald McIndoe for having explained to me in so patient and absorbing a manner the vision and the hopes for the future of the Royal College of all those eminent men who guide its destiny.

Yours sincerely,

SIMON MARKS.

Sir Simon Marks has ensured that building of Phase IIIa will go on by making an immediate contribution of £75,000, together with a covenant of £10,000 a year for the support of the Scientific departments. In addition he has indicated that further help will come from his family and his firm as the buildings progress. Within the last few days £70,000 has been received from these sources. Sir Simon assures us that Phase IIIa will be completed and equipped on time. The total cost of this will be in the neighbourhood of £250,000.

With this princely gift Sir Simon at once becomes one of the great benefactors of the College and his name will henceforth rank with those of Erasmus Wilson, Sir William Collins, Lord Nuffield and Sir Arthur Sims. Sir Simon, however, brings a new and important outlook to the role of generous benefactor. He believes that no one person to-day can assume sole responsibility for such large commitments, but that there are many who can help in a smaller way. In particular he believes that industry has a duty to fulfil in the field of scientific education. By thus widening the area of interest he would lighten the burden for those who must follow. In accepting the leadership in our cause Sir Simon Marks has once more shown his outstanding qualities of mind and heart. His wise approach to benevolence gives a lead which can be followed by others who have faith in the future of the College of Surgeons. As the President remarks, he will indeed earn the gratitude of the Royal College and of all present and future members of our great profession.

Two further letters have passed between the President and Sir Simon which will give universal pleasure. The first one adequately expressed the

SIR SIMON MARKS

feelings of the President and Council, and indeed of all surgeons; the second demonstrates the stature of Sir Simon Marks.

15th November 1957.

MY DEAR SIMON,

I wanted to write you yesterday, but I was overwhelmed with the affairs of the moment and couldn't sit down to send you a letter.

I am delighted to tell you that the Council of the College decided with acclamation to bestow upon you the Honorary Fellowship of the College, which is the greatest honour we can give to anybody.

As I told the Council, you have already identified yourself with our present work and our hopes for the future, and to make you a Fellow in name is merely to confirm you in a position which you already hold in fact.

I do hope that you will regard this decision of the Council as a sign of their appreciation not only of your gifts but of your constant interest in the College and all it stands for. To those of us who are privileged to know you a bit better than the rest it is also a sign of our affectionate regard.

Later we will make proper arrangements for your admission to the Fellowship. With kindest regards to Lady Marks and yourself.

Yours ever,

JAMES.

20th November 1957.

MY DEAR JAMES,

I am honoured by the decision of the Council to bestow upon me the Honorary Fellowship of the Royal College of Surgeons of England.

I am particularly moved by your reference to the affectionate regard in which you hold me. It is indeed a rare privilege for me to work with you and your colleagues in the next stages of development of the College.

With kind regards and thanks,

Yours sincerely,

SIMON.

Outside the Royal Family and the ranks of our own profession there are only four other holders of our Honorary Fellowship living to-day. Sir Simon's election will give pleasure to them as well as to surgeons everywhere.

A.McI.

LIFE OF SIR GEORGE BUCKSTON BROWNE, F.R.C.S.

A BIOGRAPHY HAS been written of Sir George Buckston Browne, one of the greatest benefactors the College has had, by Miss Jessie Dobson, B.A., M.Sc., and Sir Cecil Wakeley, Bt., K.B.E., C.B., LL.D., F.R.C.S.

The publishers are Messrs. E. & S. Livingstone and the price of the book is 25s. net

THE HISTORICAL SURGICAL INSTRUMENT COLLECTION in the Museum of the Royal College of Surgeons of England

by

W. E. Thompson

Museum Clerk to the Royal College of Surgeons of England.
1928—1957

"A historical collection of surgical instruments is absolutely necessary for the complete understanding of the history of surgery." (Sir Arthur Keith, *Conservator's Annual Report on the Museum*, 1911, p. 7).

THE COLLECTION OF Surgical Instruments and Appliances in the Museum of the Royal College of Surgeons of England has been built up, mostly by gifts and bequests, over the past 150 years. The earliest donation recorded is that of two flexible metallic catheters invented by the donor Mr. W. Smyth, Apothecary, of Tavistock Street, Covent Garden, presented in 1804. Later, in 1811, a set of four four-bladed lithotomy forceps was presented by Sir William Blicke, followed in 1818 by a small collection of various instruments, once used and some possibly invented by William Long, Master of the College in 1800, presented by his widow.

The Collection is perhaps unique in that it is not only a series illustrating the evolution of surgical instruments, but one in which the greater part consists of items invented, used or presented, by distinguished members of the surgical profession, in many cases closely associated with the College. A number are of particular interest as they mark the development of surgical technique.

Although donations of instruments commenced so early in the history of the College, it does not appear that any were placed on exhibition, listed or catalogued until about 1870. It is therefore assumed that they were kept in store, and judging from their condition must have been carefully preserved.

The collection aroused the interest of Sir William Flower, the Conservator, who, in his Annual Report on the Museum for 1871, states that the President at the December Council (1870) proposed the establishment of a Collection of Surgical Instruments and Appliances, both ancient and modern. The Museum Committee was accordingly instructed by the Council to consider the best method of carrying out this resolution. It was decided to use part of the house adjoining the Eastern Museum—known, before its destruction by enemy action in May, 1941, as Room V—formerly the residence of the Librarian. Access to this house was made through the partition wall and staircase at the east end of the Museum. The site of the Librarian's house occupied approximately that part of the west end of the present Great Hall on the Portugal Street side and facing Carey Street.

In the Annual Report on the Museum for the following year (1872) Sir William Flower writes that one room in the house had been fitted with suitable cases and was now ready for public inspection. Classification was,

THE HISTORICAL SURGICAL INSTRUMENT COLLECTION

in the main, that adopted by the Commissioners of the Works of Industry of all Nations in 1851. The number of instruments on view was 660. The greater part of the work of arranging and the preparation of the catalogue was undertaken by Mr. R. Williams of Weiss & Son, the celebrated firm of surgical instrument makers.

In the following Report, for the year 1873, it is noted that, at the request of Her Majesty's Commissioners for the 1851 Exhibition, a selection of the more ancient and curious instruments were lent for the purpose of forming part of the series of surgical instruments exhibited in the International Exhibition at South Kensington. This is probably the first occasion on which the Collection was called upon to supply a selection of instruments for an international exhibition. Since that time many such contributions have been loaned to International Medical Congresses, hospital celebrations, for educational films, the production of cinema films using period equipment, lectures, and for various functions held in and outside the College.

Sir William Flower again refers to the Collection in his Inaugural Address as President of the Section of Anatomy, International Congress of Medicine, held in London, August 2nd-9th, 1881. The Address, which has for its title "The Museum of the Royal College of Surgeons of England" is published in the Transaction of the Congress, 1882.

"Lastly, must be mentioned a collection—for the reception of which a separate room, approached from the end of the Eastern Museum, was devoted, in 1870—of surgical instruments and appliances, which, though small at present, contains many instruments curious for their antiquity, or interesting for their associations, and doubtless, now that a convenient and appropriate locality has been established for their reception and preservation, will be gradually augmented by additions of a similar nature. It is mainly to the interest taken in the subject which it illustrates by the late Sir William Fergusson that the establishment of this collection is due."

The revising and re-arranging of the specimens illustrating General Pathology commenced by Professor S. G. Shattock, F.R.S., in 1909, with the assistance of Dr. Cecil F. Beadles, had made considerable progress by 1911. As the space on the gallery originally allotted for this series was found to be inadequate, it was decided to devote the whole of the floor-space in Room III for this purpose. Accommodation had to be found for the miscellaneous collections of specimens, the largest being the Invertebrate Series, living and extinct, which occupied twelve floor-cases. Four cases containing specimens showing the development of the human skeleton were transferred to Room I to join the preparations illustrating normal human anatomy; two containing the Nubian pathological collection and other miscellaneous pathological specimens, drawings, paintings and photographs, were to remain—one on each side of the Hunter statue. Space was now required in other rooms or somewhere adjacent to the Museum for the remaining cases.

The College architect, Mr. E. C. Frere, was instructed to prepare plans for altering the Librarian's house as an extension to the Museum, so as

to give an upper and a lower room accessible from the staircase at the eastern end of Room V, as hitherto. Incidentally, the Librarian's House consisted of two floors, an upper and a lower, divided into several small rooms which had been used for museum purposes for over thirty years, the upper for storage and lumber and the lower for the ever growing collection of surgical instruments. The alterations were carried out during the summer months of 1911, and, when completed, the invertebrate and other specimens were accommodated on the upper floor and the instruments and a small medico-legal collection instituted by the Council in November, 1911, occupied the lower floor.

The Collection was now accommodated in a room shaped like the block letter "E" lacking the centre limb, the longest part running from north to south. The floor level was between that of the ground floor and the lower gallery of Room V—approximately six feet above the ground floor. The lower room was sometimes known as Room VII and the one above as Room VIII, but the staff knew and referred to the larger rooms by their numbers, i.e., I to V, and the smaller by the name of the collection exhibited in each—Instrument-room, Invertebrate-room, etc. Wall and floor cases were provided, most of them being from other parts of the Museum, and with the possible exception of one—that in which the Genito-Urinary System in the Male, Section "G" was exhibited—none had been specially made for the room.

Even in this large room into which cases had been crowded, space for visitors was somewhat restricted and the show-space hardly sufficient to display the collection to advantage owing to its growth. There was ample accommodation under most of the floor cases, but this was rarely used except for store purposes.

Although Sir William Flower in his Report for 1872 speaks of Mr. Williams preparing a catalogue, no copy of this has been seen. One is inclined to believe that Mr. Williams classified the collection but neither listed nor described the instruments, and that this is what Sir William Flower referred to when he used the word "catalogue."

In 1878, Mr. Walter Pye, F.R.C.S., compiled a manuscript list, which suggests that no previous list or catalogue existed. He no doubt used the classification of Mr. Williams and numbered each item, and, with the exception of the Dressing and General Section, added the letter of the Section into which it had been placed. Each item was named but no descriptions were written or measurements recorded. Notes provided by the donor were included. This volume, to which there is no introduction, preface or notes relating to the collection prior to 1878, is preserved in the Library of the College. It has been noticed that some instruments bear a number written on them in black paint or ink, and it is possible that Mr. Williams numbered the instruments so that they would remain in his order of classification.

It was not until 1912 that a descriptive catalogue of the whole collection was considered, and Mr. Alban H. G. Doran, F.R.C.S., was requested

THE HISTORICAL SURGICAL INSTRUMENT COLLECTION

by the Council to undertake this task. The collections of obstetrical and gynaecological instruments were the first to be dealt with—the former appearing in typescript in 1913 and the latter in 1914. Later, in 1921, these two sections were combined and printed as one volume and circulated to medical libraries and members of the medical profession selected by the compiler. These instruments, together with a small number from the College collection, form what is known as the "Loan Collection," as they were formerly the property of the Obstetrical Society of London and were transferred from the Royal Society of Medicine to the College on permanent loan in 1912. Therefore these sections were not included in the general scheme of the catalogue.

Mr. Doran continued with the College instruments, but first had a copy of Mr. Pye's manuscript volume typed with all additions to date included, and followed his classification making small alterations where necessary. The first section is devoted to instruments of a general nature entitled "Dressing and General Section" and the numbers were not preceded by a "sectional letter." The remaining sections, composed of instruments designed for a particular purpose, were each given a letter, as "Section A"—(Eye) and so on. The purely dental instruments, under twenty in number, were handed over to Sir Frank Colyer in 1920 and added to the Odontological Section of the Museum.

Into the compilation of this catalogue Mr. Doran threw the whole of his energy and profound scholarship. It is said that he had a knowledge of seven languages, and particularly of French, German and Latin, so that he was not bothered with having translations made. His knowledge was considered to be encyclopaedic, and it could be called upon without the slightest difficulty until a year or two before his death when his memory became slow in responding, much to his annoyance and disgust.

Each instrument was measured from all angles, and the case as well if there was one. In many instances the description of a case of instruments ran into several foolscap pages of typescript. A study of the various volumes, in print and typescript, will enable one to judge the enormous amount of research into medical literature, international in scope, and College records which has gone into its compilation. Where there is a group of one particular instrument showing variations in design, it is preceded by a historical note. Individual instruments have in some cases been treated in a similar manner and a note included in the description. Extracts from published works relating to instruments of which examples are in the collection are included in the description, either in the language in which they are printed or with a translation by the compiler; these extracts and notes have been of great value to many who have had occasion to consult the catalogue. It is probably not an exaggeration to say that no other museum possesses a catalogue of historical surgical instruments containing so much information concerning the exhibits described. It is therefore a pity that the greater part of this catalogue is in typescript; in print it would have become widely known and of immense

value to many surgical historians who seek information about the history of an instrument by a laborious search through medical literature.

Mr. Doran completed this task before his death in 1927. Some months previous to this he had to give up his visits to the College owing to failing eyesight and bodily weakness. In the nursing home where he had been placed so that he could have better attention than in his West Kensington flat, where he lived alone, he had a complete set of volumes of his catalogue which he studied continuously, and at various times I received notes containing emendations for the museum copy. It was most unfortunate that these two copies were destroyed by enemy action in 1941, as many valuable corrections and cross-references have been entirely lost. It was truly a sad occasion to see him shortly before his death brought to the College by his nurse, so that he could once again be taken to the instrument-room where, with failing sight, he looked for the last time at his beloved instruments.

The bombing of the College on the night of May 10th-11th, 1941, did considerable damage to the collection. The northern end of the instrument-room was seriously damaged by fire and collapse of the wall, and the remaining part of the room and collection by blast and water. The valuable "Loan Collection" of obstetrical and gynaecological instruments, a number of historical microscopes, cases of early amputating instruments and a series of early blood transfusion sets were lost as well as many other exhibits.

The only way of entering the room was by the windows at first floor level, in Portugal Street. This street was blocked with rubble several feet deep from the wrecked museum, as the bomb had blown the walls of Room V outwards. Although the structure of the room was in a precarious condition the remaining parts of the collection were removed via the window and over the rubble in the street. The show cases, many of which were still in good condition except for broken glass, had to be left and eventually disappeared (destroyed) when the demolition squads took over. The salvaged instruments, all showing the effects of water, were stored in the basement of the remaining parts of the College. As all available members of the male staff were busy on salvage jobs among the ruins, it was not possible to spend time cleaning the collection. The President (Sir Hugh Lett) realised that the instruments needed treatment as soon as possible and requested the Housekeeper (Mrs. Green) to put as many members of her female staff as she could possibly spare to the job of drying and greasing. After this had been done the instruments were packed into six large tin boxes, very kindly supplied and presented by the Institute of Surgical Instrument Manufacturers, through Mr. H. Guy Radcliffe Drew of Down Bros. Before these boxes were packed Mr. Drew and Mr. Phelps (of Meyer & Phelps) visited the College and identified a large number of instruments which had lost their catalogue numbers, and

THE HISTORICAL SURGICAL INSTRUMENT COLLECTION

their help proved of considerable value when the revision of the collection was undertaken. After the instruments had been cleaned the metal boxes were evacuated to St. Albans, where they remained until after the war.

All losses have been noted in the catalogue, but their descriptions have not been deleted, so that the historical notes and references are still available. In the case of Section "I" (Instruments for Operations on the Extremities), which was totally destroyed except for four specimens, this part has been removed from the series in which it was included and bound separately for ready reference. This volume has been found most useful in describing recent donations to the Section.

The revision of the whole collection was undertaken by the writer at the request of the President, Lord Webb-Johnson. The task was begun under the supervision of Professor G. Grey Turner, F.R.C.S., who was appointed Honorary Curator of the Historical Surgical Instruments in 1947; his whole-hearted interest and valuable advice together with his long surgical experience helped much in the progress of the work.

It was decided to make no alteration in the original scheme, to retain Mr. Doran's catalogue in its entirety and follow as far as possible his method of description, including historical notes and references if available. The work lasted from 1947 until 1956, and its progress is described in detail in the Scientific Reports for the years 1947-1948 to 1955-1956, and need not be referred to here except in the following instances.

As a number of cases of early amputating instruments, knives, etc., were presented during and since the war, Section "I" has been restored but in a somewhat modified form. Likewise a small number of obstetrical and gynaecological instruments having been received, these Sections were re-formed and incorporated in the general scheme of the catalogue, and given letters "U" for the former and "V" for the latter. Descriptions were not written, but all the instruments were listed and numbered and references made to descriptions or notes in the original catalogue compiled by Mr. Doran and to the literature wherever possible. Owing to the growth of Section "S" (Anaesthetic Apparatus) this also was taken out of its volume and bound separately with descriptions of all additions. Mr. N. St. J. D. Buxton, F.R.C.S., presented in 1932 a most valuable collection of anaesthetic apparatus collected by his father, the late Dr. Dudley Wilmot Buxton, a pioneer in the development of anaesthetics; and in the years 1936 and 1937, Dr. R. J. Probyn-Williams presented many interesting pieces of apparatus, some of which were his own invention. All these specimens, which had not previously been described, have been catalogued and numbered, and the Museum now possesses a unique series of over 100 pieces of early anaesthetic apparatus. Descriptions of the lost specimens proved of great value during revision and for cataloguing the additional apparatus.

There is no reference in Museum records to the appointment of a Curator for the Collection. From a study of the handwriting in Mr. Walter Pye's catalogue, it seems that the Conservator (Sir William Flower), the Pathological Curator (Professor S. G. Shattock) and others whose names are not known from the script, kept a record of additions by entering them in this volume; during the whole of the time Mr. Doran was compiling his descriptive catalogue he was never given any official title. When Mr. C. J. S. Thompson, who formerly held the post of Curator of the Wellcome Historical Medical Museum, took over in 1927, he was given the title of Honorary Curator of the Historical Section of the Museum, and continued to hold this office until his death in July, 1943. The post remained vacant until February, 1947, when Professor G. Grey Turner, F.R.C.S. was appointed and served as Honorary Curator of the Historical Surgical Instruments until his death on August 24th, 1951, when Sir Henry Souttar, C.B.E., F.R.C.S., was appointed Honorary Curator. During the war, and until revision commenced, records of donations were kept by the Assistant Conservator (Professor A. J. E. Cave, M.D.) and published in the Scientific Report for each year.

When Mr. C. J. S. Thompson, M.B.E., Ph.D., was appointed he also took charge of the Historical Room, more familiarly known in the College as the "Curio-room." The collection in this room consisted of several hundreds of specimens, relics and interesting objects which had been accumulating since the earliest days of the College Museum, and were considered unsuitable for placing or cataloguing with any of the other sections in the main museum, although a few of the earliest were to be found recorded in the first printed catalogues.

Soon after Sir Arthur Keith was appointed Conservator the specimens were collected together and arranged in some sort of order and placed on exhibition as a separate collection in a small oblong room adjacent to the upper gallery of Room V on the north side. Their cases occupied the two longer sides of the room, and in these the exhibits were placed with numbers and explanatory labels attached to each. Mr. R. H. Burne, M.A., F.R.S., the Assistant Conservator (later Physiological Curator) was responsible for the collection in an unofficial capacity until Mr. C. J. S. Thompson took over its care in 1927. Mr. Thompson transferred to this room several exhibits from the instrument-room and relics in the possession of the Secretary and Librarian. It is much to be regretted that this interesting series was destroyed, except for two or three exhibits which had been transferred to a safer place, together with the files of notes concerning the specimens. For information about this collection, although not complete, reference should be made to the "Guide to the Surgical Instruments and Objects in the Historical Series," by C. J. S. Thompson, published in 1929. A complete catalogue of the whole of the contents of the room was prepared and typed by the Museum Clerk in 1940, but this, the only copy, was lost in May, 1941.

It is not proposed to refer here to the more historical instruments, as these have been described in a series of six illustrated articles published in the *Journal of Bone and Joint Surgery*, 1953, Vol. 35B (pp. 298, 474, 667), and 1954, Vol. 36B (pp. 135, 323, 490). These papers were requested by the editor (Sir Reginald Watson-Jones), to whom grateful thanks are due for his interest and generosity in the matter of publication. The articles contain a large proportion of the most interesting specimens, but attention is drawn to some which are not recorded in these papers, such as the case of Chinese and Japanese instruments, the couching and other instruments from India, examples from Fiji, and the very interesting series made and used by the Shawiya (Berber) tribes of Algiers, presented by Captain M. H. Hilton-Simpson, who has fully described and illustrated them in his book "Arab Medicine and Surgery. A Study of the Healing Art in Algiers," published in 1922. All these instruments are catalogued in Section "T"—a section devoted to primitive types of surgical instruments and apparatus.

At various times collections of instruments have been presented to the Museum. Some of these have been kept as separate collections under the name of the donor, or that of the original owner, the items being listed but not described or entered in the general catalogue. Others have been incorporated in the catalogue, the individual items being described and placed in the section, or sections, to which they belong.

It is not proposed to enumerate all these collections, except that of Lord Lister, a note on which is given below. Some of the collections suffered considerable loss, therefore one is happy to report that the Lister Collection survived the ordeal of the bombing and remains practically intact.

The Lister Collection

This collection of surgical instruments and appliances, formerly the property of Lord Lister, was presented to the Museum in 1912 by the Executors through the President of the College, Sir Rickman J. Godlee, Bart., K.C.V.O., a nephew of Lister.

The descriptive catalogue was compiled by Mr. Doran, who divided the collection into three groups. Group I is of particular interest because it contains instruments designed or modified by Lister or are closely associated with him. These originally consisted of thirty-six specimens to which Sir Rickman Godlee and others made additions in 1920 and subsequently. Group II contains over 200 instruments of a general character, most of which came into the possession of Lister from his father-in-law, James Syme. Group III consists of forty-three instruments presented to Lister, in some cases by their inventors, but rarely or never used by him in his practice. The three Groups are kept as a separate collection so that future generations may see the equipment of a nineteenth century surgeon.

During the time Mr. Doran was preparing the catalogue he was able to obtain valuable information by correspondence or personal interviews from Sir William Watson Cheyne, Bart. (President, 1914-16) and Sir Rickman J. Godlee, Bart. (President, 1911-13), both of whom had been in close touch with Lister.

The catalogue of Group I was originally in typescript, but later, in 1928, was issued in printed form; Groups II and III are in typescript bound together in one volume. The instruments in these Groups (II and III) have been classified on the same plan as that used for the main College collection, each having a running number but without a sectional letter. To distinguish the three groups an asterisk has been placed before each number—one for Group I and two and three for the other Groups.

Group I, because of its particular value as an historical collection, is now preserved in a memorial cabinet of beautiful workmanship, designed by a former architect to the College, Mr. E. C. Frere, F.R.I.B.A., and placed in the Museum in 1925. It is perhaps unfortunate that the design of the cabinet does not permit display of what is the most interesting object in this group—the primitive spray apparatus or “donkey-engine” designed and used by Lister in the operating theatre of the Edinburgh Royal Infirmary.

Before closing this article a reference should be made to the small collection of surgical instruments and other relics, once the property of John Hunter, which was destroyed in May, 1941. The individual items were presented by various donors into whose possession they had come. A descriptive and illustrated catalogue was prepared by Mr. Doran and published in 1917. Since that date there had been several additions and the descriptions were entered in typescript in the Museum copy, which is now preserved in the College Library. One relic—Hunter's walking-stick—was not included, as this was placed with the historical collection by the late Mr. C. J. S. Thompson, the Curator at the time it was presented. The stick was for many years in the possession of Mr. W. Marrant Baker, F.R.C.S., Surgeon to St. Bartholomew's Hospital, who died in 1896. It was presented to the College by members of the Marrant Baker family on the death of his widow in 1931. Illustrations of donations made after publication of the catalogue were not included with the typed descriptions.

In spite of the losses and damage sustained by enemy action in May, 1941, the College still possesses a collection of surgical instruments and apparatus of paramount historical interest. It would not be wise, I think, to collect instruments for the sake of collecting. Donations should have some historical background, as in the case of instruments which have been handed down through several generations of surgeons in a long established family practice, or have been associated in some way with an outstanding figure in the surgical profession. Frequent examples of this association, where the surgeons have also been Fellows or Members of the College, may be seen in the present Collection.

PROCEEDINGS OF THE COUNCIL IN DECEMBER

AT A MEETING of the Council on 12th December, with Prof. Sir James Paterson Ross, President, in the Chair, Lord Webb-Johnson was elected the first Honorary Fellow in Dental Surgery of the College.

Sir Archibald McIndoe was appointed Bradshaw Lecturer for 1958 ; Mr. Norman L. Capener was appointed Robert Jones Lecturer for 1958 ; and Sir John McNee was appointed Thomas Vicary Lecturer for 1958.

The Begley Prize was presented to P. A. Evans of King's College Hospital Medical School.

Professor H. G. Radden was appointed Charles Tomes Lecturer for 1958.

A small Committee was appointed under the Chairmanship of Sir Geoffrey Keynes to be responsible for supervising the care and display of the artistic and historical treasures of the College.

The Council approved regulations for the payment of compulsory annual subscriptions.

The Council approved the draft constitution of the International Federation of Surgical Colleges.

The gift of a gong from Mr. R. F. Guymer, Fellow, was accepted with gratitude.

Diplomas of Fellowship were granted to the 87 candidates whose names are given on pages 68 and 69.

The following hospitals were recognised under paragraph 23 of the Fellowship Regulations :

HOSPITALS	POSTS RECOGNISED		
	General (all 6 mths.)	Casualty (all 6 mths.)	Unspecified (all 6 mths.)
NEWCASTLE—Newcastle General Hospital (additional)			Neurosurgery 4 S.H.O.s 1 Regr.
BATLEY—General Hospital			S.H.O. (Orth.)
DUMFRIES—Dumfries and Gallo- Way Royal Infirmary	Surg. Regr.		Surg. Regr. (Gen. Surg. and Orth.)
LIVERPOOL — Royal Liverpool Children's Hospital		Senior Cas. Off. Junior Cas. Off.	
WORDSLEY—Wordsley Hospital	Surg. Regr.		
DARTFORD—West Hill Hospital (additional)			Regr. (Orth.)
CHATHAM—All Saints' Hospital	House Officer S.H.O.		
HERTFORD—County Hospital		Continuation of tem- porary recognition until December, 1958 Cas. Off.	

GRANT OF FELLOWSHIP DIPLOMAS

AT THE RECENT Final Examination for the Fellowship three candidates out of 11 were successful in Ophthalmology, five candidates out of 17 in Otolaryngology, and 83 candidates out of 304 in General Surgery.

At a meeting of the Council on 12th December 1957 Diplomas of Fellowship were granted to the following :

BERGER, Peter Lucian (*St. George's*)
 WINSTONE, Norman Edward (*St. Bartholomew's*)
 MEHTA, Jit Shrimukh (*St. Bartholomew's*)
 BACON, Pamela Mary (*University College*)
 MACDONALD, Neil (*The London*)
 LOWRY, James Shanks (*The London*)
 BEATSON, Terence Richard (*St. Mary's*)
 COWAN, Alan Normington (*King's College*)
 GRAFF, Derek John Charles (*King's College*)
 TOOLEY, Alan Hunter (*King's College*)
 HUSE, Wilfred Martin (*Birmingham*)
 JAGOSE, Rustom Jamshedji (*Bombay*)
 †SINGH, Daryao (*Punjab*)
 STILLMAN, Irvine Roger (*Oxford*)
 BOULLE, Joseph Roger (*Cape Town*)
 CHATTOPADHYAY, Rajiba Bindu (*Calcutta*)
 BREWIN, Ernest Garside (*Leeds*)
 *McCANN, Ralph Newton (*Adelaide*)
 KIRIELLA, Leonard Penrynne Bandara (*Ceylon*)
 LUSBY, Henry Lindsay John (*Queensland*)
 SHENOLIKAR, Baiwant Kashinath (*Calcutta*)
 YEOMAN, Philip Metcalfe (*University College*)
 MARWAH, Vikram (*Calcutta*)
 TIGHE, Hugh James (*Melbourne*)
 WEISL, Hanus (*Manchester*)
 BELL, William George Thompson (*Dublin*)
 HORSBURGH, Andrew Gordon (*Westminster*)
 MILLAR, Kenneth John (*Melbourne*)
 REIMER, John Edward (*Sydney*)
 †SINHA, Achyutananda (*Patna*)
 STAUNTON, Michael Douglas Mary (*Dublin*)
 BLACKLOCK, Norman James (*Glasgow*)
 BROWNE, Michael Alexander (*Cork*)
 IRELAND, Basil John (*Sydney*)
 KATHIRKAMANATHAN, Chelliah (*Ceylon*)
 LEVITT, Solomon (*Adelaide*)
 LYTHGOE, James Philip (*Manchester*)
 PHILLIPS, John Hardwick (*Queensland*)
 *SUBRAMANIAM, Kizhakanchery Subramaniam (*Madras*)
 BHATT, Shivkumar Maganlal (*Bombay*)
 BURFITT-WILLIAMS, Walter John (*Sydney*)
 †DUNN, John Talbot (*Sydney*)
 FAIRGRIEVE, John (*Middlesex*)
 GOUGH, Malcolm Howard (*St. Thomas's*)
 GRACEY, Lionel Rodney Hubert (*St. Bartholomew's*)
 GUPTA, Roshan Lall (*Lucknow*)
 HOLBOROW, Christopher Adrian (*Middlesex*)
 KLENERMAN, Leslie (*Witwatersrand*)
 MILLS, Kingsley Wallis (*Melbourne*)
 POWER, James Graham (*New Zealand*)
 SIMMONS, Stanley Clifford (*St. Mary's*)
 TRIST, Alan Robert (*Queensland*)
 WEEKS, Robert David (*The London*)
 *WINSTANLEY, John (*St. Thomas's*)
 AMIAS, Alan Gerald (*University College*)
 BAILLIE, Roderick Charles (*University College*)
 BEITH, John McNeil (*Sydney*)
 BINNEWALD, Bertram Ralph Arnim (*Cape Town*)

GARDEZI, Syed Ali Raza (*Punjab*)
 † GRIFFITH, Adrian Nicholas (*St. Bartholomew's*)
 HADLEY, Hugh Malcolm (*Melbourne*)
 HANNIGAN, Terence Milward (*Belfast*)
 IRVING, Irene Marion (*Liverpool*)
 LAUTRE, George (*Cape Town*)
 MITTAL, Kailash Chandra (*Lucknow*)
 MONARO, James William (*Sydney*)
 RAI, Marakada Yathindranath (*Madras*)
 RAYNHAM, William Herbert (*Cape Town*)
 ROBERTS, John Bernard Michael (*Leeds*)
 ROSS, Harvey Burton (*St. Bartholomew's*)
 STEYN, John Hofmeyr (*Cape Town*)
 WATSON, Edward Cameron (*New Zealand*)
 AGRAWAL, Yogendra Nath (*Calcutta*)
 BREMNER, James Macalister (*New Zealand*)
 CLARK, Charles Grant (*Aberdeen*)
 CROCK, Henry Vernon (*Melbourne*)
 HARBISON, Peter Alan (*Adelaide*)
 HUGHES, John Dixon (*Sydney*)
 KAY, Ronald Geoffrey (*New Zealand*)
 KING, Thomas Tyrrell (*Melbourne*)
 MUKERJEE, Sandip (*Calcutta*)
 PARIKH, Anilkumar Shantilal (*Bombay*)
 TYM, Robert (*Sheffield*)
 WILLIAMS, David Bowen Morgan (*Wales*)
 CASS, Alexander Samuel (*Sydney*)
 PELLY, Anthony D'Arcy (*Sydney*)
 SEGELOV, Phillip Myer (*Sydney*)

* In Ophthalmology. † In Otolaryngology.

RESTORATION AND REBUILDING OF THE COLLEGE

DURING THE PAST two months much has been accomplished in Phase IIIa. The engineering services are now considerably in evidence, and the main risers are now in position; that is to say, for hot and cold water services, central heating, and the dry fire main. The last named is a pipe rising to the height of the building and equipped with valves on each floor. It is normally kept dry, but is available in the event of a fire for the fire brigade to connect to the street main and thus to obtain water at any height within the building or even on the roof. Electrical conduits are laid on the two topmost floors, and most in evidence of all is the ventilation trunking prominent by its great size. Drain pipes also are in position.

Structurally there has been a good advance. The main roof has for some time been finished, and as nearly all the windows are now glazed the greater part of the building is protected from the weather, though a lower roof over a part of the building has yet to be asphalted and provided with the domed light which is to form the top of the rotunda. The pointing of the walls is all but finished. Partition walls are well advanced except on the ground floor, and the lift shaft is nearly complete. Most of the work in progress is on the upper floors and from now onwards it is more or less a matter of working from the top downwards. The plastering of the walls on the top floor is to start shortly.

THE SURGEONS OF THE "BOUNTY"

Jessie Dobson, B.A., M.Sc.

Curator of the Anatomy Museum, Royal College of Surgeons of England

WHEN, IN 1787, those merchants of London interested in the West India possessions brought to the notice of George III the benefit that the introduction of the bread-fruit tree into these regions would bring, the King graciously gave his consent to the launching of an expedition for this purpose. Sir Joseph Banks, the naturalist, superintended the arrangements on board for the disposing of the plants, which were to be collected from Tahiti: and he named the ship chosen—the "Bounty"—and recommended Lieutenant Bligh to command her. Bligh had been sailing master on the "Resolution" under the command of Captain Cook during his second voyage round the world from 1772 to 1775; and subsequently, during his service in the Royal Navy, gained a reputation for his skill as a navigator.

Holding the official post of surgeon on the "Bounty" was Thomas Huggan, who had been approved as Second mate by the Surgeon's Company on 3rd August 1769. In a letter written to Sir Joseph Banks, Bligh writes of him "My surgeon, I believe, may be a very capable man, but his indolence and corpulency render him rather unfit for the voyage. I wish I may get him to change . . . if I find no possibility of getting rid of my surgeon, I think it would be very proper for me to endeavour to get some young man as Surgeon's mate and enter him as A.B., for I am aware how improper any application for one publicly would be at this crisis." And this, in fact, was the arrangement, for Thomas Denman Ledward, having qualified as Surgeon's mate on 4th October 1787, in a letter written on board the "Bounty" on 10th December, tells how he came to be taken on the strength: "The *La Nympe* was paid off about a week ago and I immediately agreed with Captain Blythe (*sic.*) of the 'Bounty' to go with him to Otaheite to transplant Breadfruit trees to Jamaica; we go by Cape Horn and return by the Cape of Good Hope. The Navy Board has not allowed her a Surgeon's mate but the Captain was unwilling to trust the lives of 45 men so far from home with only one medical person on board. I therefore do the duty of a Surgeon's mate though only entered as an able Sailor."

It was fortunate that Bligh showed such foresight, for only a month after the departure from Spithead on 23rd December 1787 his entry in the ship's log reads: "I now find my doctor to be a drunken sot, he is constantly in liquor, having a private stock by him which, I have assured him, shall be taken away if he does not desist from making himself such a beast."

Although it had been intended to take the Cape Horn route to the Society Islands, severe storms led to a change in course to continue the journey eastwards round the Cape of Good Hope. It was during these gales that Huggan fell and dislocated his shoulder, which was reduced by Ledward

with the records, "great satisfaction and, I hope, credit." To add to the problems resulting from the alteration in plan and the difficulties of navigation during so long a period of bad weather, there were now several cases of sickness on board. The men complained of rheumatic pains; but Huggan maintained that they were suffering from scurvy. Bligh reports, however, that "the doctor's opinion is of little value as he has been constantly drunk these last four days and is ever so when he can get liquor." Ledward was by now almost entirely engaged in doing Huggan's work. Bligh was evidently much troubled by this state of affairs, for he writes: "If it is ever necessary this should be publickly known, I may be blamed for not searching his Cabbin and taking all liquor from him . . . but my motive is I forbear making a publick matter of my disapprobation of his conduct in expectation, as he has done many times this voyage, he may turn sober again."

On arrival at Otaheite on 25th October, Huggan was seriously ill as a consequence of his continued intemperance and he died on 9th December. Ledward was now made ship's surgeon. When the "Bounty" set sail again on 4th April more than a thousand bread-fruit trees and many other plants had been put on board. On Tuesday, the 28th, the mutiny broke out and Bligh with eighteen of the ship's company began the perilous journey of nearly four thousand miles in a small boat twenty-three feet long from stem to stern, across a sea where the navigation was but little known. In a letter written home, Ledward stated "As soon as I was informed fully how the matter stood, I instantly declared I would go with the captain, let the consequence be what it may, and not stay among the mutineers." He had to leave behind his books, medicine chest and instruments, for the boat was already overloaded.

After a month's voyage of almost intolerable severity, the castaways sighted the barrier reef of "New Holland" but by this time Ledward and Lebogue, the sailmaker, was suffering lamentably from the effects of exposure and lack of food. On 10th June, Bligh writes: "There was a visible alteration for the worse in many of the people, which gave me great apprehensions. An extreme weakness, swelled legs, hollow and ghastly countenances, a more than common inclination to sleep, with an apparent debility of understanding, seemed to me the melancholy presages of an approaching dissolution. The surgeon and Lebogue, in particular, were most miserable objects. I occasionally gave them a few teaspoonsfuls of wine out of the little that remained, which greatly assisted them."

Four days later, they came safely to anchor in Coupang Bay in the island of Timor. They were scarcely able to walk, their bodies nothing but skin and bones, clad in rags. The people of the island gazed on them with a mixture of horror and pity and immediately showed them every mark of kindness and hospitality.

Although all but one had survived the dreadful ordeal of forty-one days at sea in an open boat, only twelve of the eighteen reached England again. One, Nelson, the botanist, died at Coupang, and three others in Batavia,

where the rest had proceeded after two months' recuperation in Timor, Bligh and twelve others sailed together for England but one of these did not survive the journey. Ledward alone remained in Batavia more fully to regain his strength before travelling home. He took a passage in a Dutch vessel—and lost his life when it foundered between Batavia and the Cape.

Whatever may be thought of William Bligh and his conduct both as Captain of the "Bounty" and later as Governor of New South Wales, Ledward at least found little reason to complain of him for he says: "The Captain, though a passionate man is, I believe, a good-hearted man and has behaved very handsomely to me."

APPOINTMENT OF FELLOWS AND MEMBERS TO CONSULTANT POSTS

K. HARRISON, M.D., D.L.O., F.R.C.S.

Consultant E. N. T. Surgeon, Stockport
and Buxton Group of Hospitals.

The Editor is always glad to receive details of new appointments obtained by Fellows and Members, either through the Hospital Boards or direct.

ANATOMICAL MUSEUM

THE SPECIAL DISPLAY for the month of January consists of a selection of John Hunter's dried preparations.

DIARY FOR JANUARY (27th-31st)

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|----------|------|--|
| Mon. 27 | | Basic Sciences Lectures and Demonstrations begin. |
| Tues. 28 | 5.00 | DR. D. H. M. WOOLLAM—Arris and Gale Lecture—The experimental approach to the problem of the congenital malformations.* |
| Wed. 29 | | Primary F.R.C.S. Examination begins. |
| | 5.00 | PROF. A. SORSBY—Ophthalmology Lecture—Experimental degeneration of the retina.* |
| Thur. 30 | 5.00 | PROF. G. F. MURNAGHAN—Hunterian Lecture—The mechanism of congenital hydronephrosis.* |
| Fri. 31 | | Basic Sciences Lectures and Demonstrations for Dental Students end. |

DIARY FOR FEBRUARY

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| Tues. 4 | 3.45 | DR. A. A. BARTON—Arnott Demonstration.* |
| Wed. 5 | | D.O. Examination and Final L.D.S. Examination (Part I) begin. |
| Thur. 6 | 5.30 | MR. R. H. FRANKLIN—Otolaryngology Lecture—Congenital abnormalities of the oesophagus.* |
| Mon. 10 | | Anaesthetic Course begins. |
| Wed. 12 | | Final L.D.S. Examination (Part II) begins. |
| | 7.30 | Monthly Dinner. |
| Thur. 13 | | D.M.R.D. and T. Examinations (Part I) and D. Phys. Med. Examination (Part I) begin. |
| | 2.00 | Ordinary Council. |
| | 5.00 | PROF. A. J. H. RAINS—Hunterian Lecture—Biliary obstruction in the region of the porta hepatis.* |
| Mon. 17 | | Course in Clinical Surgery begins. |
| Wed. 19 | | D.Phys.Med. Examination (Part II) and D.T.M. & H. Examination begin. |
| Thur. 20 | 3.45 | DR. F. STANSFIELD—Arnott Demonstration.* |
| Fri. 21 | | Anaesthetic Course ends. |
| Wed. 26 | | Primary F.D.S. Examination and D. Orth. Examination begin. |

* Not part of courses.



2

THE APPLICATION OF PHYSIOLOGICAL PRINCIPLES TO HORMONE-DEPENDENT BREAST CANCER

*Imperial Cancer Research Fund Lecture delivered at the Royal College of Surgeons of
England

on
14th May 1957
by

Geoffrey Hadfield, M.D., F.R.C.P., F.R.C.S.

Director of Clinico-pathological Research, Imperial Cancer Research Fund

INTRODUCTION

Mitosis in normal mammary epithelium is totally hormone dependent. Total hypophysectomy induces mitotic arrest and general atrophy in the mammary glands of non-pregnant animals, yet a vigorous growth response can be readily induced in the dormant epithelium of these atrophic mammae by the administration of the hormones which are known to be essential for the early phases of normal mammogenesis. This experiment is even more convincing when a full mammary growth response, corresponding to that of mid-pregnancy in the *female*, is artificially induced in the atrophic and rudimentary mammae of the totally hypophysectomised weanling *male*.

The total hormone dependence of the normal mammary gland is an inborn biological characteristic deeply imprinted on its epithelial cells and in all probability on its mesenchyme. Mammary epithelium shares this hormone dependence with the cells of approximately 50 per cent. of human breast cancers in which a growth regression can be induced in the tumour by endocrine ablation. It is difficult to deny, therefore, that hormone dependence in breast cancer is anything more than the retention by tumour cells of a basic attribute possessed by the normal epithelium from which the tumour cells take origin; it is, of course, well recognised that the cells of many malignant tumours retain, to varying degrees, some of the specific physiological characters of the normal cells from which they arise.

All available evidence suggests that progressive growth in hormone dependent human breast cancer is controlled by the same group of hormones which is essential for normal mammogenesis. It must be admitted, however, that the breast cancer patient may produce these hormones over abnormally long periods or in unphysiological proportions, and recent experimental observations, to be referred to later, lend some support to this supposition (Bielschowsky, 1956). It is clear, however, that the investigation of hormone-dependent breast cancer, as well as its rational treatment by endocrine ablation, must be based on our

*The historical introduction to this lecture has been omitted and more recent work in experimental mammogenesis is included.

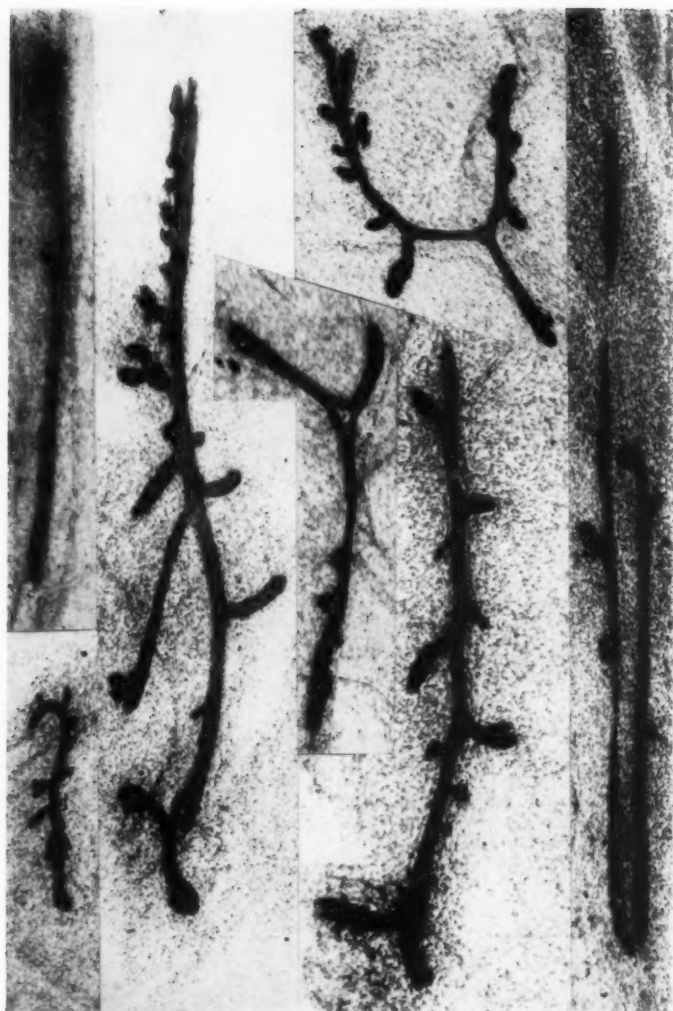


Fig. 1. Seven rudimentary mammary glands from intact untreated weanling male A₂G mice, aged twenty-three to twenty-eight days. $\times 50$.

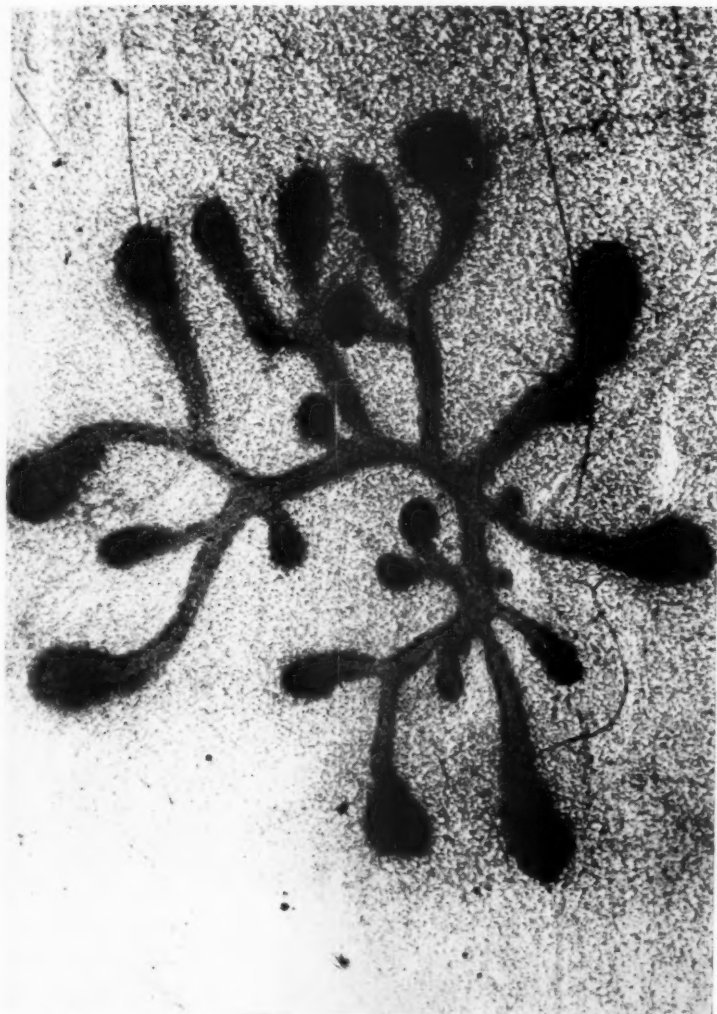


Fig. 2. Mammary gland of a weanling male A₂G mouse given 1.25 μ g. oestrone twice daily for five days. Note free production of clubs, eighteen in number, and rapid formation of a duct system. $\times 50$.

knowledge of mammary physiology and more especially on the complex inter-play of those hormones which control the proliferation by mitosis of normal mammary epithelium.

The majority of hormone dependent mammary cancers are spheroidal-celled carcinomata. They show little or no differentiation. Their major and sometimes, apparently, their only biological activity is mitotic division and their degree of malignancy is primarily determined by the rate at which their cells divide. These characteristics suggest that the hormonal requirements of the poorly differentiated breast cancer may be simpler than those which enable the normal gland to accomplish full differentiation, lactogenesis and lactopoiesis. The evidence now available strongly suggests that the initial mitotic phase of normal mammary growth needs an oestrogen together with progesterone and the pituitary hormone prolactin, whereas the final phases of full glandular differentiation and lactogenesis in the normal breast appear to need the addition of growth hormone and A.C.T.H.

NORMAL MAMMOGENESIS

As it is so frequently necessary in experimental mammogenesis to judge the type and to measure the intensity of a mammary growth response induced by the administration of hormones, a short account of the early stages of normal and artificially induced mammary growth may be of assistance. A convenient preparation for this purpose is the mamma of the weanling male mouse between the ages of twenty-three and twenty-eight days. In males of this age the glands grow very slowly and are rudimentary in structure. They can be readily "feminised" and an artificially induced growth response in them is easily recognised and can be measured with reasonable accuracy.

A collection of seven normal glands from weanling males of the Strong A₂G strain, aged about twenty-three days, is shown in Fig. 1. These preparations were made by staining the fixed pelt in alum carmine and dissecting out the mammae, which are then mounted "whole" without sectioning. Some glands consist of little more than a main duct, others have developed a few branches and it is important to observe that the free ends of some of the ducts are very slightly swollen and that in others no swelling is discernible. These "weanling" glands grow slowly for about forty days, i.e., up to the age of approximately sixty days, by which time the animal is in full sexual maturity, the gland has grown considerably in area, a fairly complex system of branching ducts has developed but the free ends of the ducts are not conspicuously swollen.

A series of mammary growth responses induced in the weanling male by oestrone given over a period of five days is illustrated in Figs. 2 and 3. An extensive duct system is in the course of rapid formation and each duct terminates in a conspicuous deeply-stained club-like swelling. In the weanling male breast the presence of these "clubs" is a clear indication that a rudimentary male gland is being rapidly "feminised" by an exogenous stimulus. The histological structure of two such "clubs" is shown in Figs. 4, 5 and 6. Each club presents an arresting picture of intense mitotic activity in a mass of closely packed undifferentiated epithelial cells. These richly cellular clubs rapidly produce a duct system by pushing their way through the breast fat and "spinning out" epithelial cells behind them. This aggressive-looking process is facilitated by the production of hyaluronidase by the immature cells of the "club" and it is interesting to recall that hyaluronidase production is also a characteristic of several rapidly-growing malignant tumours, suggesting that the occupation

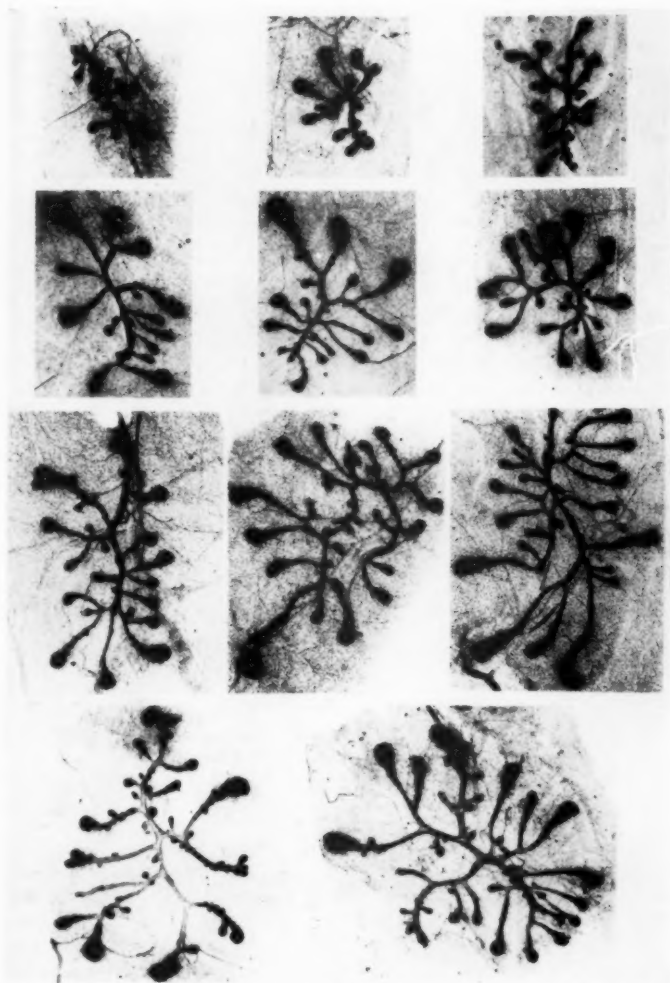


Fig. 3. Growth response to oestrone in eleven mammae from a group of intact weanling male A₂G mice. The number of clubs per gland varies from twelve to twenty-two, the mean number (i.e., "mammatrophic potency of stimulus") being seventeen. $\times 10$.

of a connective tissue territory by a rapidly developing normal organ or by a malignant tumour is achieved by a similar or possibly identical chemical mechanism.

As the normal mammas of the intact weanling male have few or no clubs, the presence of these structures in significant numbers in the rudimentary mammas of weanling males affords irrefutable evidence of a recent growth response artificially induced by a specific exogenous mammary stimulus. The intensity of such a response induced in the mammas of a group of weanlings can be estimated by determining the mean number of large, deeply-staining clubs per gland. That this method is reasonably accurate is supported by the fact that it gives a straight line log-dose response curve in intact animals whose glands are responding to exogenous ovarian or pituitary hormones.

It is of great interest to compare the histogenesis of the early mitotic phase of normal mammatogenesis (as seen in Fig. 7a) with the histological structure of a spheroidal cell carcinoma of the human breast (Fig. 7b). This histological similarity is striking in that both present a picture of rapid cellular proliferation with no cellular differentiation. The fundamental difference lies in the fact that cellular proliferation in the "club" is invariably, inevitably and proportionately inhibited as glandular differentiation becomes established; in cancer it is unchecked and "perpetual."

So far, only the initial phase of normal mammatogenesis has been described. This brings the gland into being, and even when epithelial proliferation is still active the early stages of glandular differentiation become apparent in the terminal clubs and in the walls of the ducts (Figs. 8 and 9). The mitotic phase now sharply declines and in the weanling male mouse extensive rudimentary glandular acinisation can be induced in five days (Fig. 10). Brief reference must be made to the histogenesis of the mesenchymal reaction in a normal mammary growth response. Figure 6 shows the early envelopment of the terminal club by reacting mesenchyme in which myoepithelial cells as well as proliferating fibroblasts can be identified.

The completion of glandular differentiation to produce mature acinisation of the gland needs no detailed description but it is fundamental to decide if the mitotic phase of mammatogenesis in the normal human breast is comparable with that of the mouse. This is best studied by examining thick sections of the human breast in which the lobules can be seen in three dimensions. This technique, developed by Ingleby (1942) and Parks (1956), shows that the early stages of human mammatogenesis are characterised by the same formation of cellular and infiltrating terminal clubs as in the mouse (Fig. 11).

OVARIAN HORMONES IN NORMAL MAMMATOGENESIS

The interpretation of results obtained by artificially inducing mammatogenesis in intact animals possessed of gonads, adrenals and a pituitary has obvious limitations and may be misleading. Such results should therefore be controlled by repeating the observations on gonadectomised, adrenalectomised or, preferably, hypophysectomised animals. As the placenta becomes an active endocrine organ during pregnancy, mammary growth reactions obtained in pregnant animals are particularly difficult to evaluate.

1. Ovarian oestrogenic hormones

We now know that the *oestrogenic phenolic steroids* induce a mammary growth response in the *intact* animal of many mammalian species. Satisfactory responses are obtained in both male and female animals whether

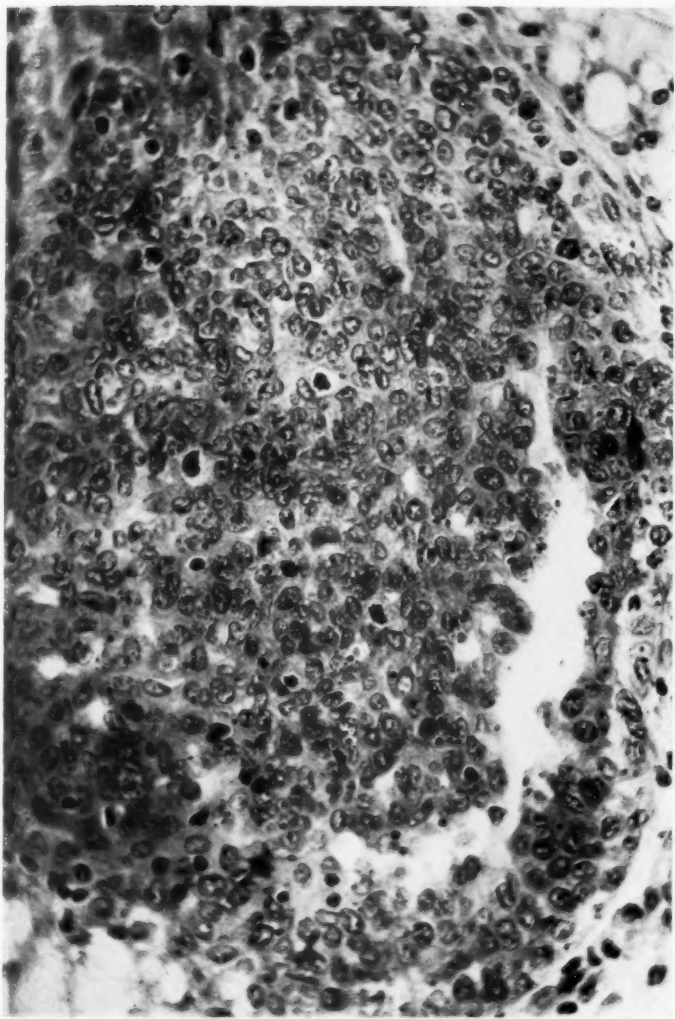


Fig. 4. High power view of a club in section showing total lack of cellular differentiation, considerable mitotic activity and nucleolar prominence in resting nuclei. $\times 450$.

they are sexually mature, immature or weanlings. It has already been mentioned that male weanlings have considerable experimental value as their undeveloped, simple, but remarkably sensitive mammae provide an excellent zero base line for estimating the intensity of a growth response.

In the majority of species (e.g., rats, male and female monkeys, dogs, mice and cats) there is free production of new ducts without glandular differentiation or milk secretion. In a minority of species (e.g., guineapig, virgin female goat and the virgin heifer) the reaction extends to widespread acinisation of the ducts and lactogenesis. In a small minority of mice acinisation can be readily induced. All experimental evidence shows that the optimal dose levels of the oestrogenic steroids are low and lie between narrow limits, and that large doses are inhibitory. This latter fact is physiologically important and has a direct bearing on the treatment of breast cancer by hormone therapy.

2. Ovarian progestational hormones

Exogenous progesterone alone has little or no significant or constant effect on mammogenesis. On the other hand, it is firmly established that, in the *intact* mammal, progesterone together with oestrogenic steroid forms a powerful mammogenic and lactogenic synergistic combination which can bring the male or female, mature or immature mamma of the intact animal to the structural status of mid-pregnancy, provided that the two hormones are administered in optimal proportions, the dose of oestrogen being invariably low and that of progesterone relatively large.

3. Gonad-pituitary relationship

There is sufficient evidence, which will be referred to later, that the oestrogenic steroids constitute the specific appropriate stimulus for the release of prolactin from the hypophysis. This must be regarded as one of their major functions although many believe that they have a direct mitogenic effect on mammary epithelium, and that they induce general dilatation with increased permeability of the mammary capillaries. It is well established, however, that in the absence of the hypophysis neither oestrogen nor progesterone alone or in combination can induce a mammary growth response in the hypophysectomised rat or mouse, and that their inability to do so arises from lack of a mammotrophic pituitary hormone and is unrelated to the absence of pituitary gonadotrophin.

THE ADRENAL-GONAD RELATIONSHIP

With obvious limitations the adrenal cortex can be regarded as a secondary sex organ. There is a low output of oestrogenic steroids from the adrenal cortex in the intact mammal. Adrenal cortical tumours accompanied by virilism produce an excess of androgen whilst those accompanied by feminism produce a gross excess of oestrogen. The "physiological castration" of the menopause is followed by a fall in ovarian oestrogen production, to be succeeded in approximately 50 per cent. of post-menopausal women by a resurgence of oestrogen production which

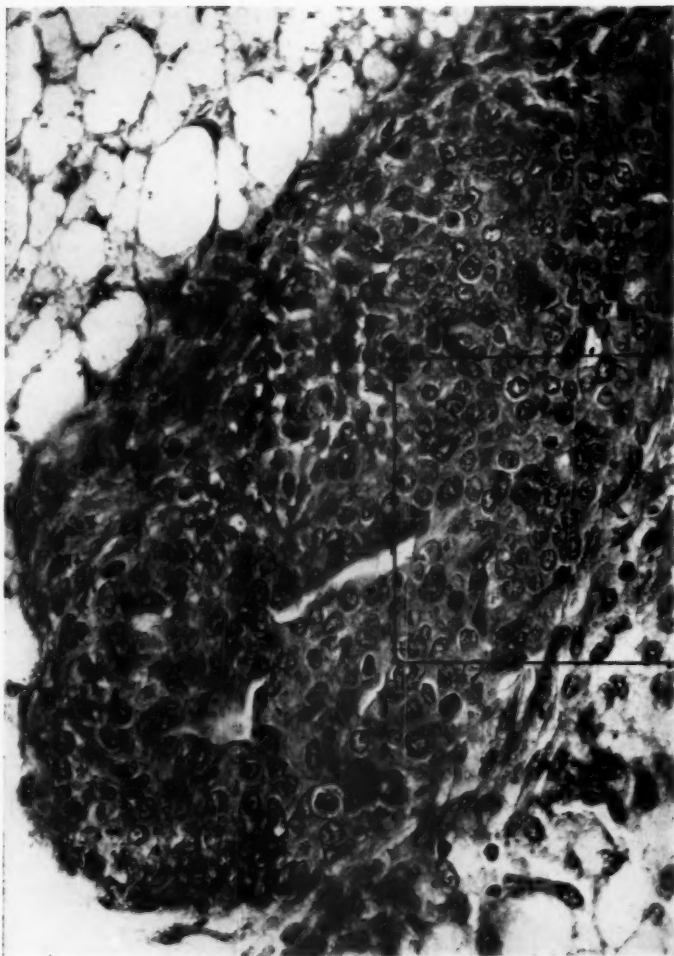


Fig. 5. High power view of a club in section, showing all the characteristics seen in Fig. 4, but this club is more compact and there is well-defined mesenchymal reaction at its periphery. $\times 450$.

induces varying degrees of vaginal cornification, endometrial hyperplasia and irregular proliferation of the mammary glands. As the post-menopausal ovary is no longer responsive to pituitary gonadotrophin, the source of this post-menopausal oestrogen is presumably the adrenal cortex for its production can be abolished, at least temporarily, by adrenalectomy.

This adrenal "take-over" can be induced in a grossly exaggerated form in certain strains of inbred mice if gonadectomised at the age of three days. Such animals develop considerable adrenal enlargement from diffuse or nodular cortical hyperplasia, and this is accompanied by the clearest evidence of excessive oestrogen production in the form of cystic glandular hyperplasia of the endometrium, vaginal cornification and a vigorous growth reaction in the duct system of the breast. This adrenal response is mediated through the pituitary and can be abolished by exogenous oestrogen.

There is now abundant clinical and biochemical evidence that oophorectomy in human pre-menopausal breast cancer is usually followed by a fairly precipitate but temporary fall in oestrogen production. This is almost invariably followed, after a period measured in months, by a resurgence of oestrogen production which strongly tends to be abolished by adrenalectomy. After a variable period, sometimes measured in years, continuous oestrogen production is once more established. The source of oestrogen in such oophorectomised and adrenalectomised women can be occasionally verified at operation by finding accessory adrenal tissue but in the majority the search in the living patient is unsuccessful. On the other hand, aberrant cortical tissue has been found in the retroperitoneal tissues from the upper pole of the kidney to the gonad. Graham (1953) in 100 consecutive post-mortems examined blocks of tissue which included the abdominal aorta and inferior vena cava from just below the origin of the renal arteries to 3cms. above the origin of the coeliac axis. In 68 no accessory adrenal tissue was found; in 32 adrenal tissue was present, and in sixteen of these, miniature, reduplicated adrenal glands were found, having an average size of $7 \times 4 \times 3$ mm. and containing cortex and medulla showing a normal anatomical pattern. These miniature adrenals were found in the area lying between the origins of the coeliac and superior mesenteric arteries, fifteen of them were 2 to 3cm. from the midline—eight to the left, three to the right, two were bilateral—and three were lying in the midline. On purely embryological grounds oestrogen producing tissue could arise, possibly without producing a discrete and easily recognisable nodule, in the undifferentiated mesenchyme of the retroperitoneal tissues, from which the gonads and adrenal cortices are derived. Such a process would be comparable to myeloid metaplasia which so frequently occurs in the liver and spleen in myeloid leukaemia.

It appears, therefore, that no surgeon can guarantee permanently to remove the whole of the active and potential oestrogen-producing tissues in the human breast cancer patient. This is the probable explanation

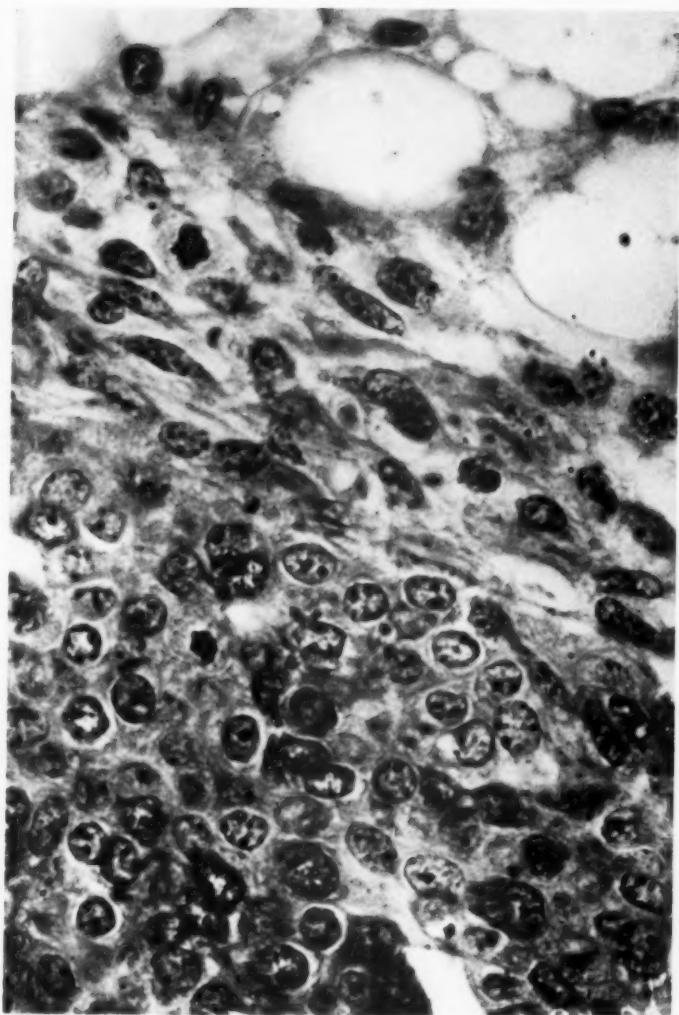


Fig. 6. Higher power view of area enclosed in rectangle in Fig. 5, showing cytological detail of epithelial and mesenchymal response to mammotrophic stimulus. $\times 1,000$.

for the re-establishment of oestrogen production and the high rate of growth recurrence which eventually follows adrenalectomy. In any case it is clearly unjustifiable to "write off" the frequent failure of adrenalectomy to achieve permanent growth regression by assuming that the tumour cells have developed "secondary hormone independence" unless this supposition is justified by estimations which indicate the rate of production of ovarian and pituitary hormones.

THE HYPOPHYSEAL HORMONES AND NORMAL MAMMOGENESIS

The mammary atrophy which follows total hypophysectomy may be ascribed to deprivation of oestrogenic and progestational ovarian hormones which must inevitably follow the loss of pituitary gonadotrophin. There is, however, an imposing mass of evidence which points to the existence of another pituitary hormone having a direct, specific and essential influence on the growth and differentiation of mammary epithelium. The first hint of the existence of such a hormone was supplied by Stricker and Grueter in 1928 when, by injecting unfractionated aqueous anterior pituitary extracts into ovariectomised pseudo-pregnant rabbits, their mammary glands were induced to lactate. In the next year this response in the rat was shown by Evans and Simpson (1929a) to be preceded by unequivocal mammary growth, and this was confirmed by Corner in 1930. Three years later the extract used was fractionated by Lyons and Catchpole and its lactogenic potency greatly increased. On injection it induced free growth of the mammary ducts with extensive acinisation and lactation was again initiated. From about 1930 there was a growing belief that to define the normal function of a target organ such as the ovary it was essential to use hypophysectomised animals, and that the biological response to any substance deemed to be, or to contain, an anterior pituitary mammogenic hormone cannot be accepted as specific unless it can be repeatedly elicited without any doubt in the non-pregnant hypophysectomised animal. From 1920 onwards, Philip E. Smith perfected the technique for hypophysectomy in laboratory animals in the investigation of somatic growth and sexual function. The growth responses of the mammary gland induced by hormones were re-investigated in hypophysectomised animals between 1932 and 1935 but the results were anomalous until, in 1937, Gomez and Turner proved that hypophysectomy, to be of any value, must result in total extirpation, confirmed by serial sections of the sella turcica. During 1936 and 1937 a series of ten careful studies was made on six mammalian species* and it was conclusively proved that *the ovarian oestrogenic and progestational hormones, singly or in combination, are completely powerless to induce a growth response in the mammae of totally hypophysectomised animals*. Meanwhile considerable efforts had been made, by repeated fractionation, to isolate the pituitary mammogenic factor in a state of relative purity. The potent fraction was referred to as *prolactin* and this name is now in common use.

*i.e., rats, guinea-pigs, mice, rabbits, cats and ground squirrels.

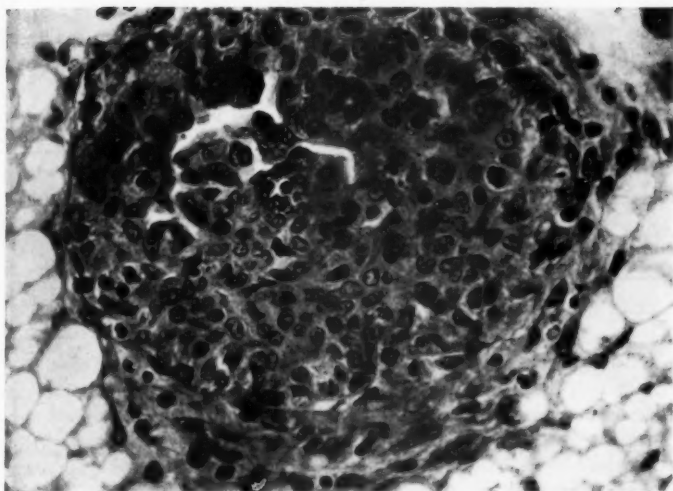


Fig. 7a. A club cut at right angles to its long axis showing lack of differentiation, mitotic activity, multipolar mitosis and nucleolar prominence. $\times 450$.

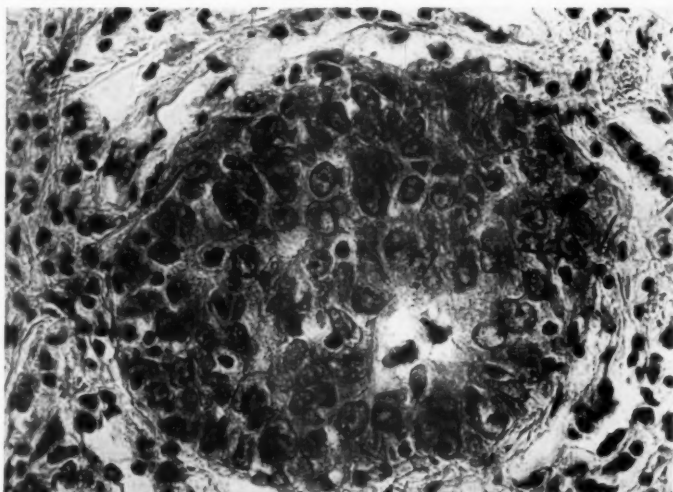


Fig. 7b. Transverse section of an infiltrating cellular prolongation of a spheroidal-cell carcinoma of the breast. $\times 450$.

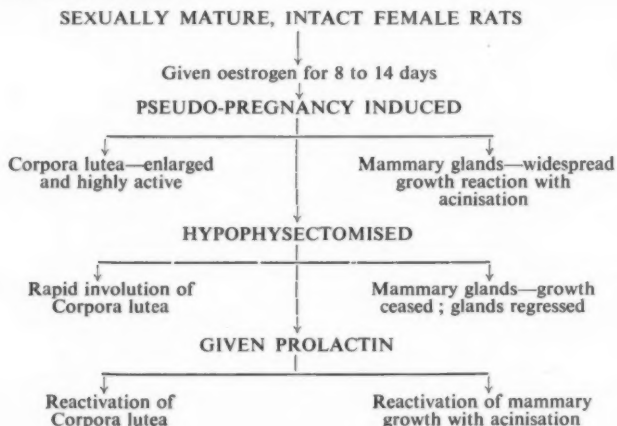
The mammogenic triad

With such a preparation, Gardner and White (1941, 1942) obtained the following results in hypophysectomised mice :

Hormone	Mammary growth response	Duct growth	Acinisation
Oestrogen and progesterone	Nil	Nil	Nil
Purified prolactin	±	±	Nil
Oestrone and progesterone with purified prolactin ..	++	++	++

Prolactin as a luteotrophin

At this time an experiment having considerable significance was reported by Evans and Simpson (1929*b*). By repeatedly fractionating pituitary extracts they isolated a product which had the characters of a homogeneous protein. This was injected into hypophysectomised female rats whose ovaries contained follicles and corpora lutea. It might have been expected that, by deprivation of pituitary gonadotrophin, the corpora lutea would rapidly atrophy. It was discovered, however, that their structure and function were fully maintained by this apparently homogeneous protein which possessed all the other biological characters of prolactin. This experiment opened up a new field for it strongly suggested the possibility that prolactin was the trophic hormone responsible not only for mammogenesis and the initiation of lactation but also for another progestational phenomenon, i.e., the maintenance of the corpus luteum and the production of ovarian progesterone. These observations were confirmed by a series of experiments performed by Nelson (1952) and may be summarised as follows :



The Californian experiments

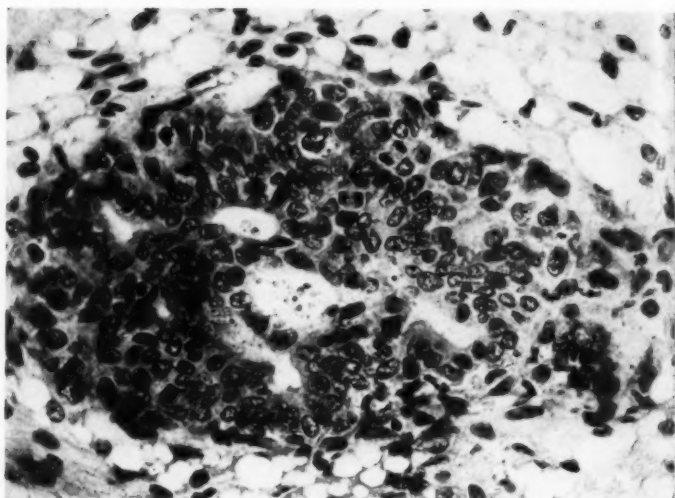
About 1943 it was increasingly obvious that the oestrogenic steroids, the progestational steroid produced by the corpus luteum, together with pituitary prolactin, were inseparably linked together as a synergistic triad in stimulating the proliferation and differentiation of mammary epithelium, and from this time up to 1955 an impressive programme of research into this problem was carried out by Lyons, Li and their colleagues in the Hormone Research Laboratories attached to the Department of Anatomy of the University of California, Berkeley. The following is a summary of a large scale experiment in eight stages performed between 1950 and 1952 on hypophysectomised-oophorectomised rats :

MAMMOGENESIS IN HYPOPHYSECTOMISED AND OOPHORECTOMISED RATS :

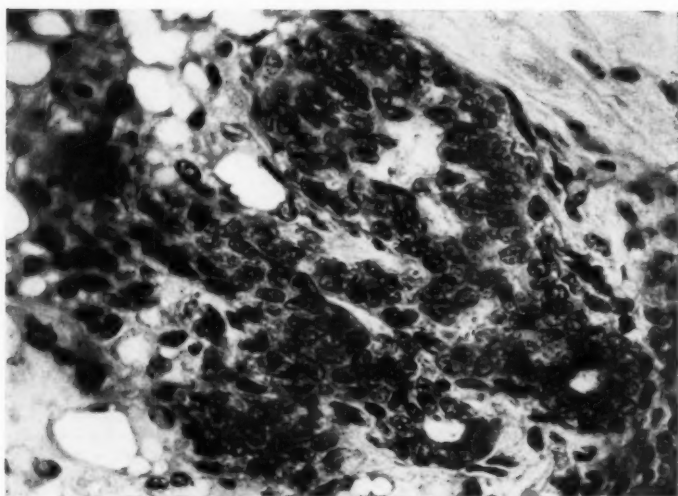
EXPERIMENTS OF LYONS, LI AND ASSOCIATES, 1950-1952

Given	Result	
1. Oestrone	Mammary atrophy	Pituitary mammotrophin lacking
2. Oestrone and progesterone	Mammary atrophy	Pituitary mammotrophin lacking
3. Purified prolactin	Regression delayed No mammary growth	Ovarian hormones lacking
4. Purified prolactin + oestrone	Regression delayed No mammary growth	Progesterone lacking : No ovary
5. Oestrone + progesterone + purified prolactin	Mammogenesis ++ to status of mid-pregnancy No lactogenesis	Full lactogenesis + lactopoiesis needs adrenal cortical hormones (<i>vide infra</i>)
6. Oestrone + progesterone + crude prolactin	Mammogenesis +++ to full-term pregnancy Lactogenesis ±	Crude prolactin may contain A.C.T.H. or G.H. or both
7. Oestrone + progesterone + purified prolactin + G.H.	As above, but Lactogenesis +	
8. Oestrone + progesterone + purified prolactin, G.H. + A.C.T.H.	Growth to full-term pregnancy Lactogenesis +++	Full lactogenesis needs intact pituitary adrenal axis

In 1955 the same experiments were carried out on hypophysectomised, gonadectomised immature male rats, aged twenty-eight days. Acinisation and lactation were induced in these rudimentary male glands and the general results obtained were substantially the same as in the mature female. A third series of similar experiments was planned in which extracts of twelve-day rat placentae were substituted for pituitary prolactin and, by means of the prolactin-like hormone which is known to



(a)



(b)

Fig. 8. Clubs from mouse mamma reacting to prolactin :

- (a) A few primitive gland tubules are recognisable but epithelial mitosis is still in evidence.
- (b) Acinisation is a little more advanced and cellular proliferation less obvious.

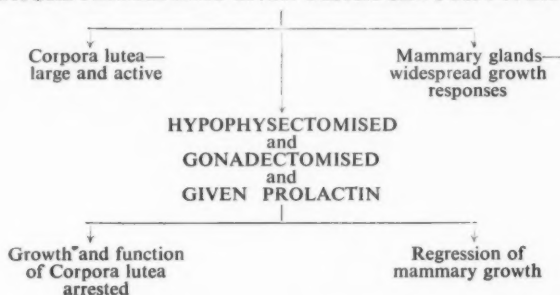
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IMPERIAL CANCER RESEARCH FUND LECTURE

be produced in large amounts by the placenta, substantially the same results were again obtained.

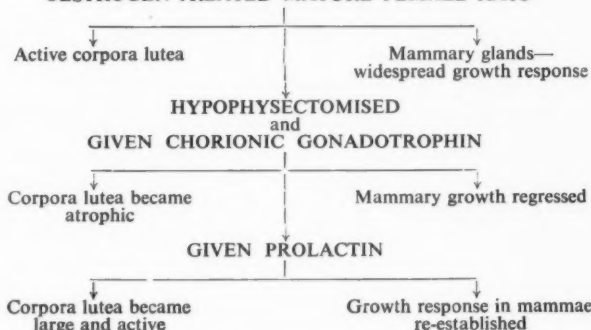
During the period 1950 to 1953, Nelson, working in the Department of Medical Anatomy of the State University of Iowa, and using another approach, provided strong support for the general conclusions which emerged from the Californian researches. Nelson's work relating to the luteotrophic function of prolactin has already been mentioned. His further work (1952) may be summarised as follows :

MATURE FEMALE RATS GIVEN OESTROGEN FOR 8-14 DAYS



CONCLUSION—Ovarian hormones are essential for normal mammogenesis.

OESTROGEN-TREATED MATURE FEMALE RATS



CONCLUSION—Pituitary Gonadotrophin could not maintain the function of the corpus luteum but this was re-established by Prolactin.

It has recently been established in the Clinicopathological Laboratories of the Imperial Cancer Research Fund (Hadfield, 1957) that no mammary growth response can be induced in hypophysectomised weanling male mice either by ovarian oestrogenic and progestational hormones acting

alone or in combination, or by prolactin alone, The combination of oestrone, progesterone and prolactin, however, rapidly produced a vigorous mammary response in five days.

The rôle of growth hormone and A.C.T.H.

In several of the latest experiments on normal mammogenesis, the combination of ovarian oestrogenic and progestational hormones together with pituitary prolactin has been shown to bring the mammary gland to the status of mid-pregnancy. The induction of a fully developed and functionally competent gland corresponding to the mammary gland of full-term pregnancy appears to need the participation of growth hormone and A.C.T.H., and it may well be that fully developed glandular differentiation and the initiation of lactation cannot take place in animals deprived of these hypophyseal hormones. On the other hand, the hypophysectomised mammal has taught us that no combination of hormones which does not include pituitary prolactin can stimulate and maintain the vigorous proliferation by mitosis of mammary epithelium which is primarily responsible for bringing the breast into being.

Prolactin release

There is a close functional relationship between the ovary and the pituitary. Rasmussen (1928, 1934) established that the mean weight of the anterior lobe of 110 men between the ages of twenty and seventy-five years was 387.6mg. whilst in ninety-three women between sixteen and eighty-six years it was 560mg. Evans and Simpson (1929*b*) found that this proportionate weight difference in the two sexes was almost identical in rats. Hohlweg (1934) first demonstrated that oestrogen administration is followed by a substantial increase in pituitary weight in rats, and in the next year, Selye, Collip and Thomson reported an increase in pituitary weight of at least 40 per cent. in lactating rats after the administration of small doses of oestrogen over ten days. In 1936, Martins grafted the pituitaries of rats into their own eyes and demonstrated that the grafted glands reacted to oestrogen as vigorously as the intact pituitary, showing that the oestrogen acts directly on pituitary tissue. Uotila, in 1940, demonstrated that section of the pituitary stalk did not diminish the pituitary growth response to oestrogen.

Pituitary response to hyperoestrinisation

Many reports confirm that long-continued administration of oestrogen at a relatively low dose level (i.e., hyperoestrinisation) is often followed by the production of nodular enlargement of the pituitary. In many instances these pituitary "tumours" are due to simple hyperplasia as they totally regress after withholding oestrogen. Mice have been extensively used in the study of nodular hyperplasia of the pituitary due to hyperoestrinisation as they show a low incidence of spontaneous pituitary

tumours. Gardner and Strong (1940) showed that there is a wide strain variation in the incidence in mice of pituitary "tumour" formation following hyperoestrinisation. In some strains the response, which is always preceded by a lag period, is remarkable for its vigour, the pituitary tumours reaching an enormous size, their weight approaching that of the animal's brain; sutures are widely opened, the head is misshapen, and intra-cranial pressure rises. In other strains the pituitary proved to be refractory to exogenous oestrogen.

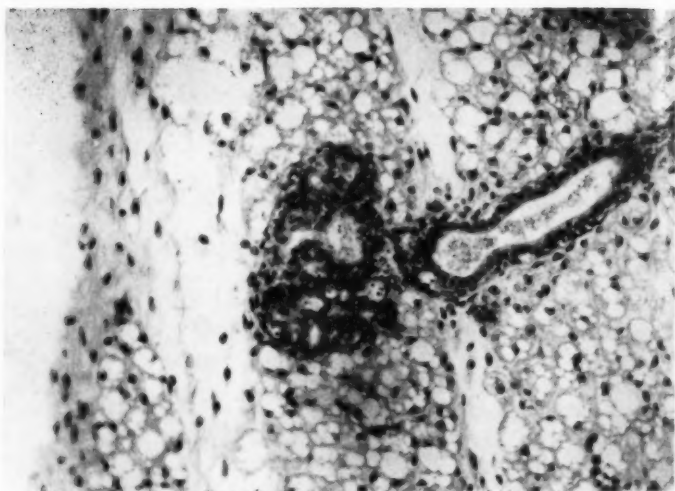
After a preliminary period of stimulation, the output of gonadotrophin from the hyperplastic pituitaries of hyperoestrinised animals is diminished or arrested. Observations by Rowlands and Sharpey-Schafer (1940) suggest that this is true in women. The effect may be comparable with the adrenal cortical atrophy which follows the administration of A.C.T.H., or the atrophy of the pancreatic islets which follows insulin administration.

There are, however, good reasons for supposing that prolactin production may be maintained, possibly at a relatively high level, in the hyperoestrinised animal. It has been reported by several observers that active corpora lutea develop at an abnormally early age in animals when continuous oestrogen administration is started soon after birth. This clearly suggests that the oestrogen induces the release of prolactin which is then free to exert its luteotrophic function. It has been shown by Meites and Turner (1942) and by Chamorro (1952) that the mammatrophic potency of the pituitaries of rodents is significantly increased by hyperoestrinisation.

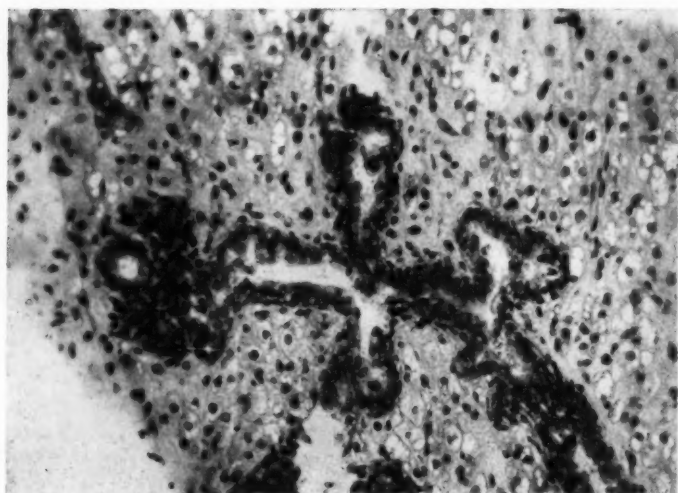
Furth (1956) has recently recorded the results, in rats, of continuous and long-continued stimulation of the pituitary by exogenous oestrogen. In one series of experiments pellets of stilboestrol were implanted subcutaneously; in another series, animals bearing oestrogen-secreting granulosa cell tumours of the ovaries were used. In the stilboestrol experiment, tumour-like nodules appeared in the pituitary; these were successfully grafted into the subcutaneous tissues of other animals and were passaged through other hosts. The animals bearing pituitary "tumours" and those bearing subcutaneous grafts showed unmistakable hyperplasia of the mammary glands with glandular differentiation and the formation of milk-like secretion. These experiments suggest that the release of prolactin by oestrogen can take place in pituitary tissue uncontrolled by the hypothalamic nuclei.

The life history of a strain of mice (NZY) recently reported by Bielschowsky (1956) is of particular interest in this connection. In this strain spontaneous pre-mature ovarian activity was found to be closely associated with, and in all probability responsible for, the following sequence of events:

1. Early sexual maturity.
2. Premature formation of active corpora lutea.



(a)



(b)

- Fig. 9. Reacting mammae showing early glandular differentiation
(a) Duct terminating in a group of gland tubules forming a rudimentary terminal lobule.
(b) Similar picture but there is free production of primitive acini from lateral walls of ducts. $\times 200$.

3. Very considerable, symmetrical or nodular, hyperplasia of the pituitary in the large majority of the females together with outspoken hyperplasia of the mammary glands.

4. An incidence of mammary cancer reaching 58 per cent. in breeding females over the age of six and a half months, and 35 per cent. in virgin females during the second half of life.

It must be emphasized that this paper records the life history of a spontaneous disease. It is based on meticulous examination of the organs of a very large number of animals from birth to the full development of breast cancer, and it brings together a natural sequence of events which illustrates most of the physiological principles of mammogenesis laboriously established by the experimentalist over the last thirty-five years.

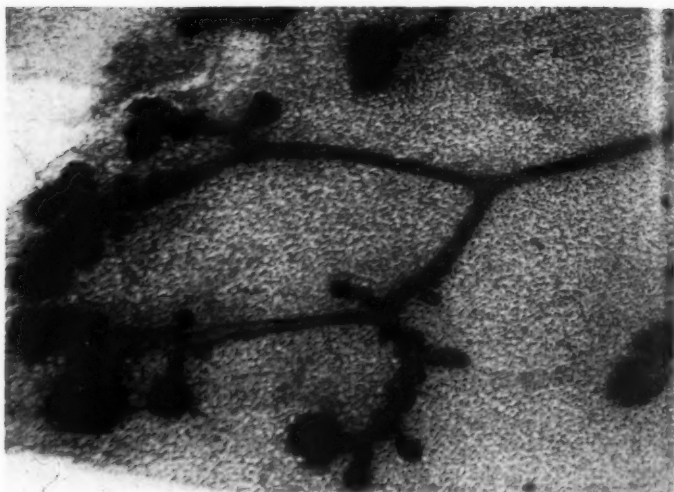
In most of the older reports on the pituitary response to exogenous oestrogen the cells in the hyperplastic anterior lobe are described as "chromophobic." Both Furth and Bielschowsky are satisfied that the hyperplasia is due to the overgrowth of eosinophil cells together with others which can be recognised as partly degranulated acidophils. The acidophil cell may well be concerned with the elaboration of both growth hormone and prolactin. In Bielschowsky's experiments these predominating acidophils in the pituitary were probably not engaged in producing growth hormone as the female mice gave no indication of a somatic growth response in excess of the males in whom pituitary hyperplasia was absent.

It will now be clear that a major action of the ovarian oestrogenic steroids is to release prolactin from the pituitary and that this release, if adequate, will lead to the liberation of progesterone from the corpus luteum.

It may be of assistance to reduce the interplay of hormones in normal mammogenesis to diagrammatic form (Figs. 12 and 13). These relationships do not preclude the possibility that the oestrogenic steroids have a direct and specific stimulating effect on the growth of mammary epithelium.

Purity of hypophyseal hormone preparations

In spite of intensive study of the physico-chemical properties of the protein hormones of the hypophysis, it is difficult to obtain a preparation of prolactin which, when submitted to bioassay, does not induce some degree of somatic growth in young animals. When large doses are used this effect may lead to experimental difficulties. The fact that any one hypophyseal hormone preparation may be contaminated by other hypophyseal hormones calls for care and accuracy in determination of dosage and caution in the interpretation of experimental results. The possibility that growth hormone (somatotrophin), possibly acting at low dose levels, may play an essential part in the early phases of normal mammogenesis must be borne in mind.



(a)



(b)

Fig. 10. Parts of a mouse mamma reacting to mammothrophin in human female urine. (a) Clubs of early growth phase persist. Outlines of some are broken by formation of acini and there is irregularity of outline in some ducts due to the same cause. (b) In this field about eight terminal clubs have been totally replaced by formation of glandular acini. Acini are also arising along the ducts. $\times 50$.

APPLICATION TO HUMAN BREAST CANCER

Naturally-occurring regressions

Spontaneous regression of tumour growth is not an uncommon event in the natural history of human breast cancer. Such regressions may be as brief as a few months to a year or two but exceptionally may persist for ten years or even longer. They tend to occur in growths which, arising a year or two before the onset of the menopause, have already spread by blood-borne metastasis before the second post-menopausal year. A growth regression which is total and in all probability due to mitotic arrest in the tumour cells, is then established and may persist for one to four years (Hadfield and Holt, 1956).

It is difficult to deny that such naturally-occurring regressions are the consequence of oestrogen deprivation induced by the "physiological castration" of the menopause. On this assumption, complete oestrogen lack would totally inhibit the release of prolactin from the hypophysis and therefore reduce progesterone production to zero. The regression would continue until the adrenal cortex became established as an oestrogen-producing target organ under the stimulus of pituitary gonadotrophin, which is known to be produced in increasing quantities as the production of oestrogen by the ovaries progressively falls.

These considerations suggest that naturally-occurring growth regressions in breast cancer are related to a naturally-occurring alteration in the hormonal environment of the patient's tissues. In any case there can be little doubt that in patients treated by hormone therapy, with or without endocrine ablation, during the first three or four post-menopausal years, a spontaneous growth regression may be mistaken for a therapeutic response.

Laboratory investigations

At the present time ablative or additive hormone therapy is largely empirical. It can be rationalised and, to a limited degree, controlled by correlating clinical signs and symptoms with repeated estimates of the endocrine status of the patient obtained by laboratory methods designed to assess the level of production of the hypophyseal, ovarian and adrenal hormones known to be concerned in the early phases of normal mammatogenesis.

The following are some of the estimations usually employed in such studies; with the exception of vaginal cytology, none of them is readily applicable to routine clinical work because of their complexity and high cost:

Steroid metabolism

- (a) Estimation of phenolic oestrogenic steroids in urine.
- (b) Degree of oestrogenic stimulation of the vagina—by vaginal cytology.
- (c) Estimation of urinary pregnanediol—the excretion product of progesterone.



Fig. 11. Human mammary gland. Thick section (150μ) cleared in oil of wintergreen. Five uncut rudimentary lobules, which lie between the two faces of the section, are morphologically comparable with early growth phase the of reacting mouse mamma. (Stained by alum carmine). $\times 20$.

Pituitary function

(a) Pituitary gonadotrophin—by bioassay based on the induction of uterine growth by urinary extracts.

(b) Pituitary mammotrophin—by estimating mammary growth response induced in male mice by human urine.

(c) Protein-bound blood iodine—to judge completeness of hypophysectomy.

Estimation of urinary oestrogens

Of the several methods available, that developed by Brown (1955) of the Medical Research Council Clinical Endocrinology Unit, University of Edinburgh, yields consistently accurate results.

The urine is subjected to acid hydrolysis and extracted with ether; the extract is dissolved in alcohol; benzene and petroleum ether are added and the product is extracted with water. The water extract carries the oestriol fraction. This is methylated, and caustic soda and hydrogen peroxide added. A final extraction with ether yields a product which is adsorbed on an alumina column and estimated by the Kober reaction as oestriol methyl ether. Similar treatment of the water insoluble primary ether extract yields oestrone and oestradiol-17 β methyl ethers which are estimated by the same reaction.

The following summary of results obtained by this method in the Clinicopathological Laboratories of the Imperial Cancer Research Fund is based on 2,250 estimations of urinary oestrogens in 400 breast cancer patients.

1. *Before and after oophorectomy.* Oophorectomy in pre-menopausal women causes a marked reduction in oestrogen excretion but rarely abolishes it. A fall to zero may occur but is almost invariably temporary. There is no correlation between oestrogen levels and regression of tumour growth. In post-menopausal women, oophorectomy has little appreciable effect on oestrogen excretion (Bulbrook and Greenwood, 1957).

2. *Before and after oophorectomy and adrenalectomy* (fifty patients). In 70 per cent. of cases oestrogen excretion virtually ceased but in a minority of these cases oestrogen production at very low but biologically active levels was re-established (Bulbrook, Greenwood and Williams, 1957). Oestrogen excretion continued in 30 per cent. of all cases; this was erratic and alternated with periods of zero excretion, emphasising the fact that unless estimations are repeated at short intervals periods of increased oestrogen output are likely to be missed. A fall of oestrogen excretion to zero levels was not invariably accompanied by regression of tumour growth but clinical deterioration with growth acceleration showed a tendency to be accompanied by an oestrogen production at high levels (Bulbrook and Greenwood, 1957).

3. *Before and after hypophysectomy.* Of eleven patients, post-operative oestrogen excretion reached zero value in four. In three the level remained

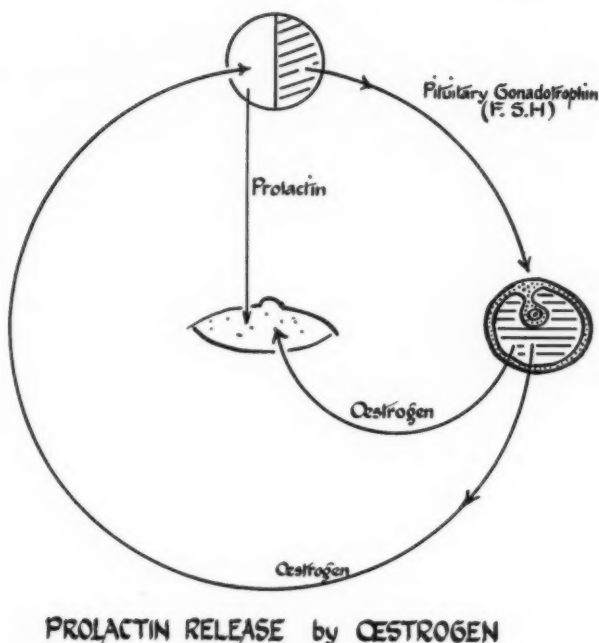
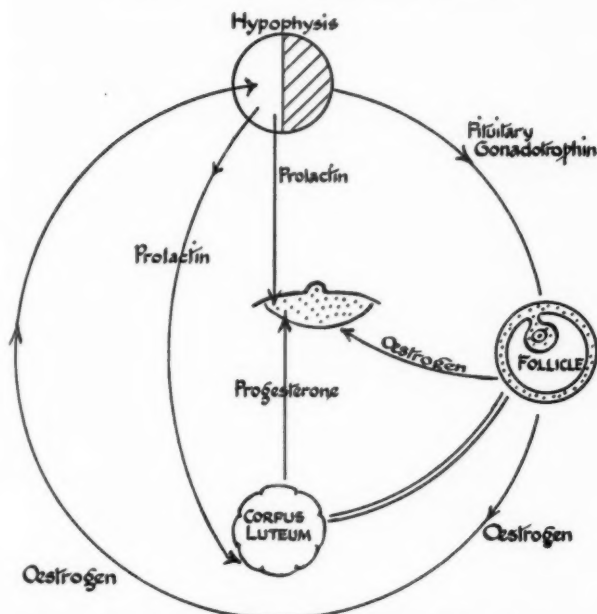


Fig. 12.

unchanged ; in three it was higher than the pre-operative level, and in one the post-operative level was exceptionally high (Greenwood and Bulbrook, 1957).

These results show that in human breast cancer there is no simple correlation between the clinical response to endocrine ablation and the level of urinary oestrogen as determined by biochemical methods. This conclusion is not surprising if examined against the background of experimental endocrinology. The mitotic phase of normal mammogenesis needs three hormones acting in synergism in optimal proportions. The fullest and most accurate estimations of oestrogenic steroids would therefore appear to be misleading if no information is at hand regarding the production of the equally important progestational steroids together with that of pituitary mammotrophin and gonadotrophin. Nor, in all probability, would the situation be much more satisfactory if a large scale correlation were made between all the steroids concerned and the clinical state of the patient.



CORRELATION of PRODUCTION and UTILISATION
of the
MAMMOTROPHIC PITUITARY TRIAD.

Fig. 13.

Bioassay of pituitary gonadotrophins

In the hands of Loraine and Brown (1956*a* and *b*) of the Medical Research Council's Clinical Endocrinology Unit in Edinburgh, an accurate method has been developed for the bioassay of this hormone in human urine. Its end-point depends on the enlargement of the uterus in intact immature mice, and results are expressed in terms of a standard preparation of human menopausal gonadotrophin as H.M.G. units per twenty-four hours.

Loraine, Strong and Douglas (1957) have investigated the urinary gonadotrophin in forty-seven post-menopausal patients suffering from recurrent or metastatic breast cancer. Bioassays were carried out before a period of six weeks during which stilboestrol dipropionate was administered. A clinical assessment was then made. The group showing clinical deterioration had a relatively high mean gonadotrophin excretion during

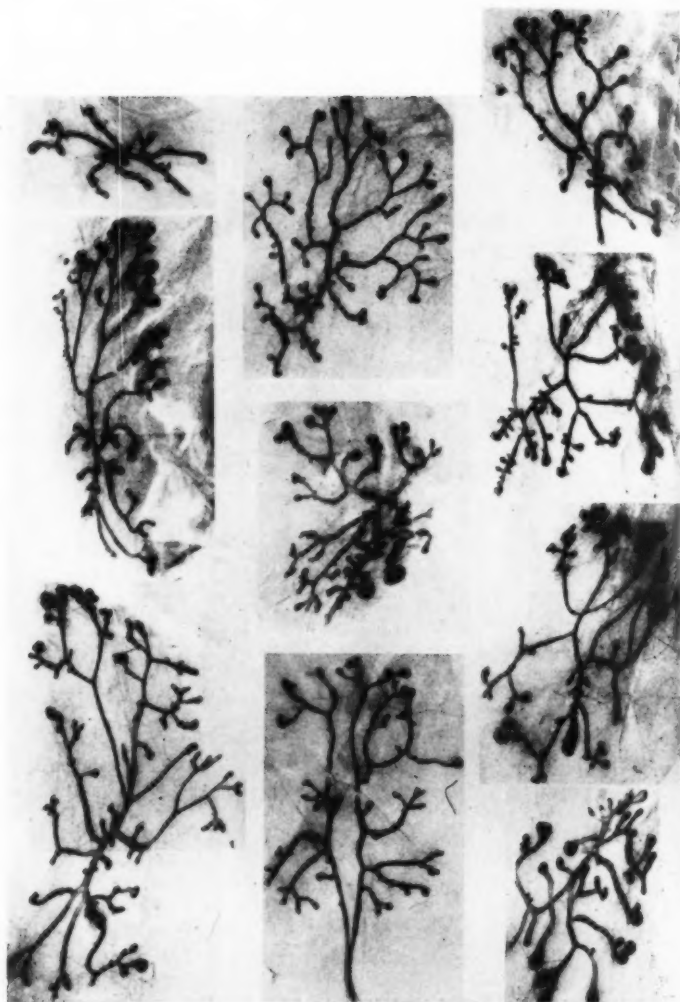


Fig. 14. Growth responses in a series of ten mammae from a group of intact weanling A₂G male mice given urine from a normal pre-menopausal woman (0.1ml. twice a day for five days). Note the well developed duct system and considerable replacement of clubs by glandular acini (see Fig. 10). $\times 10$.

IMPERIAL CANCER RESEARCH FUND LECTURE

a period of twenty-four hours before treatment; those in whom there was no clinical improvement or "no change" had a statistically significant lower mean output before treatment.

If further results confirm the correlation between a low gonadotrophin output and a favourable prognosis, this estimation is likely to help in predicting the response to endocrine ablation and, at the moment, is the only valid bioassay method which can do so.

Estimation of pituitary mammotrophin

A method which promises to yield information regarding the output of pituitary mammotrophin in the urine is being investigated in the Clinicopathological Laboratories of the Imperial Cancer Research Fund. It is based on the demonstration that the urine of all normal pre-menopausal women in the second half of the menstrual cycle, when injected into intact weanling male mice, will induce an easily recognisable growth reaction in their rudimentary mammary glands (Fig. 14) (Scowen and Hadfield, 1955; Hadfield and Young, 1956a). The urine of 57 per cent. of post-menopausal women contains the same mammogenic agent (Hadfield and Young, 1956b). The capacity to react to this urinary mammotrophin is, unfortunately, confined to a small minority of all easily available strains of laboratory mice (Young, 1957). This entails breeding and maintaining the susceptible strain and detracts from the value of the test as a routine procedure.

An attempt has been made to define the nature of this urinary mammotrophic agent using totally hypophysectomised weanling male mice (Hadfield, 1957). These were divided into six groups. A control set was left untreated; the other groups were injected with various hormone combinations for five days. The results are given in the following table and can be seen in Figs. 15, 16 and 17.

MAMMARY GROWTH RESPONSES IN HYPOPHYSECTOMISED MALE WEANLING MICE (A₂G STRAIN), SHOWING THAT HUMAN FEMALE URINE IS AN EFFECTIVE SUBSTITUTE FOR PROLACTIN IN THE "MAMMOGENIC TRIAD" (PROLACTIN, OESTRONE AND PROGESTERONE).

Group	Hormone Administered	Result
1	None	Mammary atrophy obvious on fifth day; well established on tenth day
2	Oestrone and progesterone	Mammary atrophy
3	Prolactin	Mammary atrophy
4	Oestrone, progesterone and prolactin	A vigorous growth response in almost all mammary glands of all animals
5	Oestrone and progesterone and human female urine	Growth response in almost all mammae of all animals identical with that in Group 4 but rather less vigorous

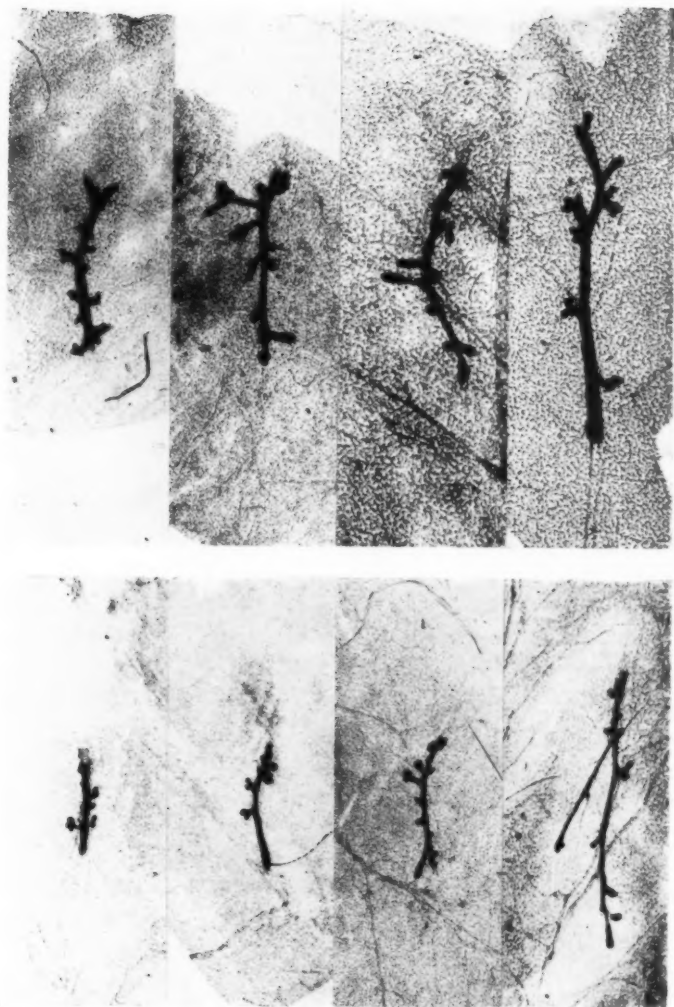


Fig. 15. Mammary glands of male weanling mice :
Upper row—Normal rudimentary glands of intact and untreated animals.
Lower row—Glands of mice eight days after hypophysectomy showing glandular atrophy. $\times 20$.

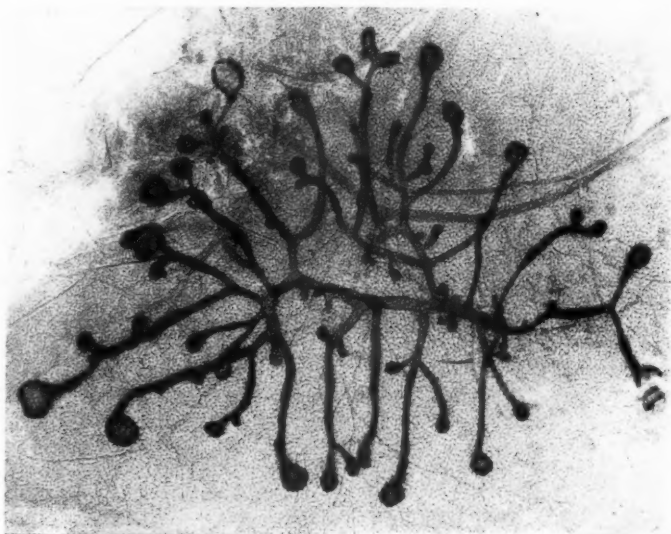
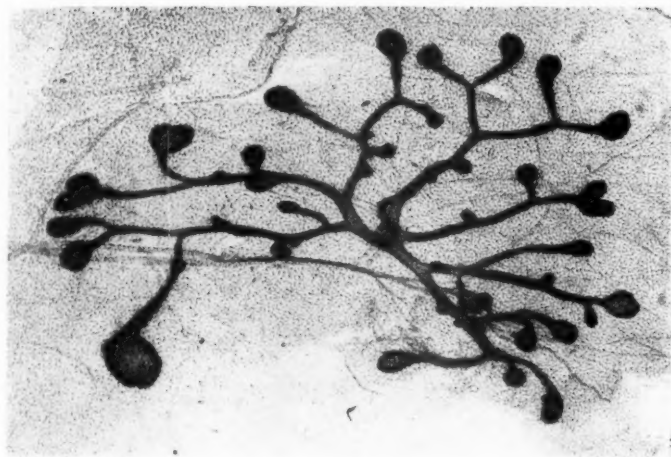


Fig. 16. Mammary glands of hypophysectomised mouse given prolactin, oestrone and progesterone. Hormones, given twice a day for five days, have induced a vigorous growth response with a profusion of cellular clubs. $\times 20$.

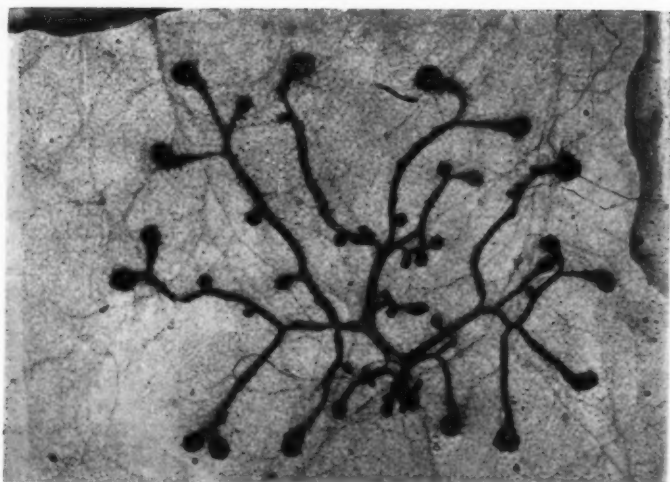


Fig. 17. Mammary glands of hypophysectomised mouse given an extract of human female urine, oestrone and progesterone. This combination, given twice a day for five days, has produced an early growth response comparable with, but rather less vigorous than, that seen in Fig. 14. $\times 20$.

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These experiments show that normal female urine contains a hormone which has a specific biological action identical with that of prolactin. They have been repeated and the first results have been confirmed. This approach promises to provide a method for the estimation of pituitary mammotrophic function in the breast cancer patient.

In conclusion I would like to present an unsolved problem for your consideration. It is based on the simple fact that the successful induction of the early mitotic phase of mammogenesis in the hypophysectomised mammal depends upon the administration of prolactin, progesterone and oestrogen in optimal proportions, a maximal mammary response being obtained only when the amount of oestrogen is relatively low and that of progesterone and prolactin relatively high. In our experiments the optimal proportion of oestrogen to prolactin was approximately 1 to 500 parts by weight. It may be, therefore, that the small quantities of urinary oestrogen lying at the low limits of accurate biochemical detection and estimation have considerable clinical significance. In any case, these considerations suggest that the ratio of oestrogenic steroids to pituitary mammotrophin may prove to have far more prognostic significance than the estimation of either hormone alone.

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MONTHLY DINNERS

MONTHLY DINNERS ARE held in the College on the Wednesday before the second Thursday of each month. The following are entitled to attend with their guests; all diplomates and students of the College and members of the Associations linked to the College through the Joint Secretariat. It is not necessarily intended that guests should be members of the medical profession.

The next four dinners will be held at 7 for 7.30 on 12th March, 16th April, 7th May and 11th June.

The cost is £1 10s. 0d., which includes cocktails before dinner and wine at the table. Applications for tickets, accompanied by a cheque for the appropriate amount, must be sent to the Deputy Secretary at least a week before the date of the dinner. Cheques should be made payable to "Royal College of Surgeons of England." The dress is lounge suit.

ANATOMICAL MUSEUM

THE SPECIAL DISPLAY for the month of February consists of a demonstration of the artists of the Hunterian Museum.

SAYINGS OF THE GREAT

"A man wrapped up in himself makes a very small parcel."—*Frequent saying of the late Dr. Richard Downey, Archbishop of Liverpool.* (Submitted by Mr. W. R. Probert, F.R.C.S.)

(Contributions are invited.)

NEOMYCIN IN OPHTHALMOLOGY

Ophthalmology Lecture delivered at the Royal College of Surgeons of England
on

11th January 1957

by

Arnold Sorsby

Research Professor in Ophthalmology, Royal College of Surgeons and Royal Eye Hospital
and

Joseph Ungar

Research Division, Glaxo Laboratories, Greenford, Middlesex

INFECTED CORNEAL ULCERS with hypopyon formation, and intraocular infections generally, have become uncommon in recent years, but such cases as are seen to-day frequently give a poor response, or none at all, to penicillin therapy—a striking contrast to the brilliant results seen when penicillin was first used adequately some ten years ago. It is likely that in ophthalmology, as in general medicine, the widespread use of penicillin has allowed the spread of strains of penicillin-resistant staphylococci responsible for the uncontrolled infections now seen—an assumption suggested by the high frequency of penicillin-resistant strains of staphylococcus aureus met inside hospitals. Thus in a series at the Royal Eye Hospital, the organism was penicillin-resistant in four out of twenty-six out-patients with staphylococcus aureus; in in-patients the corresponding figures were nineteen out of sixty-one. The in-patients were likely to have received some form of penicillin treatment prior to admission: they thus represent a somewhat selected population in relation to penicillin. Penicillin to-day is therefore often a prophylactic rather than a therapeutic agent in the narrower sense, so that whilst it will frequently prevent the onset of an infection, it is unwise to assume that it is an adequate remedy for an established infection. It may, indeed, be adequate for some infections, but will be inadequate not only for infections due to penicillin-resistant staphylococcus aureus but also for those due to gram negative organisms—a group that presents a particularly difficult problem. Gram negative infections were first separated as a small but distinctive group from the mass of corneal infections at a time when they proved resistant to penicillin in the early penicillin days (Sorsby, 1950; Sorsby and Burn, 1950); to-day these infections with their characteristic clinical features—though numerically probably not more common than in the past—constitute a substantial proportion of the corneal infections seen. What with penicillin-resistant staphylococcus aureus and gram negative organisms—and together they probably contribute about half of the infected eyes seen to-day—ophthalmology no less than general medicine needs the so-called broad spectrum antibiotics, and the present study was devoted to exploring the potentialities of the available agents.

1. Preliminary assessment of available agents effective against penicillin-resistant staphylococcus aureus

Owing to the presence of the blood-aqueous barrier, systemic administration of antibiotics is not a particularly satisfactory procedure for the treatment of intraocular infections. The previous studies on penicillin (Sorsby and Ungar, 1946; 1947) and streptomycin (Sorsby, Ungar and Bailey, 1952) have shown the value of subconjunctival injections in reaching and maintaining high intraocular concentration of the antibiotics. Solubility and local tolerance are essential characteristics required of any agent to be used for subconjunctival injection. This restricts the choice of agents. As can be seen from Table I, magnamycin had to be eliminated because of poor local tolerance; and as was to be expected, massive doses of penicillin and streptomycin given intramuscularly, singly and in combination, had no effect; nor was there much promise in bacitracin though it was well tolerated locally. Erythromycin and neomycin were the only two agents calling for further consideration on the grounds of efficacy. The erythromycin in common use is, however, insoluble, but this was not an altogether insuperable difficulty, for a relatively soluble hydrochloride compound could be obtained by treatment with hydrochloric acid, and erythromycin lactobionate could also be obtained in solution: a more tangible difficulty was that these compounds were somewhat irritant, limiting the possible dose in a subconjunctival injection. The most promising agent was neomycin, which was well tolerated in subconjunctival injections of 100 mg., and gave some partial control of experimental infection with penicillin-resistant staphylococcus aureus inoculated into

TABLE I
PENICILLIN-RESISTANT STAPHYLOCOCCUS AUREUS
Organism: Staph. Aureus Nos. 17512; S192; S230. Dose: 100×10^6
PRELIMINARY TRIALS

	Dose	Route*	Tolerance	Result		
				Con- trolled	Partial control	Uncon- trolled
Magnamycin ..	10,000 U.	S.C.(1)	—			×
Bacitracin ..	100 mg.	S.C.(1)	+			×
Neomycin ..	100 mg.	S.C.(1)	+		×	
Erythromycin HCl	100 mg.	S.C.(1)	±		×	
Neomycin ..	100 mg.	S.C.(2)	+		×	
Erythromycin lactobionate ..	100 mg.	I.M.(3)†	±		×	
Penicillin ..	1,000,000 U.	I.M.(3)	+			×
Streptomycin ..	1 g.	I.M.(3)	+			×
Penicillin and Streptomycin ..	1,000,000 U. and 1 g.	I.M.(3)	+			×

* S.C.—Subconjunctival and I.M.—Intramuscular. The figures in brackets give the number of doses; throughout the investigation recorded in this and the subsequent tables a first dose was generally given 2 hours after infection and the second and third doses 24 and 38 hours later.

† Much muscle damage.

NEOMYCIN IN OPHTHALMOLOGY

the anterior chamber. Infection of the eye was established by inoculating the anterior chamber with staphylococcus S17512 in the manner recorded previously in the study on penicillin (Sorsby and Ungar, 1946). In *in vitro* tests (30 µg.) neomycin was effective in thirty consecutive cases of coagulase positive staphylococcus aureus, including seven that had proved insensitive to penicillin.

2. Control of infection with penicillin-resistant staphylococcus aureus Erythromycin

Oral administration of erythromycin gave unpromising results. As can be seen from Table II (a), rabbits receiving 250 mg. orally in one dose did as badly as rabbits receiving 300 mg. divided over three doses. The results were rather better when erythromycin hydrochloride was given in doses of 100 mg. subconjunctivally, in one experiment on two occasions, and in another experiment on three occasions. Taken together with the local irritability, these results did not encourage further work on this agent.

Neomycin

Table II (b) shows that more promising results were obtained with neomycin given subconjunctivally. In a first series of experiments, two subconjunctival injections of neomycin in doses of 100 mg. gave eight satisfactory results in fourteen animals, against none in the 14 controls. When the dose was increased to 500 mg. per injection in three experiments and to 750 mg. in one further experiment, the results were distinctly better, nineteen out of thirty animals recovered against none in the controls ;

TABLE II
INFECTION WITH PENICILLIN-RESISTANT STAPHYLOCOCCUS AUREUS*
Infecting dose : 100×10^6
(a) ERYTHROMYCIN

Mode of administration	No. of rabbits	Dose (mg.)	No. of administrations	Results					
				Very Good	Good	Fair	Poor	Very Poor	Died
Oral	6	250	1	—	—	—	1	5	—
"	13	100	3	—	1	1	—	9	2
Subconjunctival ..	7	100 ¹	2	1	1	3	2	—	—
"	5	100 ¹	3	1	—	4	—	—	—
(b) NEOMYCIN									
Subconjunctival injections	14	100	2	2	6	—	5	1	—
	14	Controls	.. ..	—	—	—	—	14	—
Subconjunctival injection	7	500	2	—	4	—	1	2	—
"	7	500 ²	2	—	4	1	2	—	—
"	8	750	2	1	3	—	1	3	—
"	7*	500	2	4	1	2	—	—	—
"	8*	500	2	4	2	1	1	—	—
	37*			9	14	4	5	5	—
	32	Controls	.. ..	—	—	—	—	32	—

(1) HCl added to ensure solution.

(2) Together with 100 mg. Erythromycin orally, 3 doses.

* S17512 was used throughout, except for the last two experiments in which S192 and S230 were used respectively.

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in the one experiment where three doses of erythromycin orally, 100 mg. each, were also given the results were substantially the same. As with penicillin therapy for infections due to penicillin sensitive organisms, control of the infection was achieved within twenty-four hours, though full recovery took up to ten days or more.

The data in Table II (b) also show that three different strains of penicillin-resistant staphylococcus aureus were used in these observations, and they raise the possibility that neomycin is not equally effective against all strains of this organism.

3. Neomycin in the control of infections with gram negative organisms

Experimental assessment of the value of an agent against gram negative infection of the eye faces the difficulty that it is not easy to obtain an

TABLE III
INFECTION WITH GRAM-NEGATIVE BACILLI

(a) *Ps. pyocyanea* Infection of Cornea

Infecting dose : One loopful of an overnight broth culture of *Ps. pyocyanea* (Hoare).

	No. of rabbits	Dose : 2 subconjunctival injections each containing :	Result		
			Controlled	Partial control	Uncontrolled
Controls	6		—	—	6
Polymyxin B. ..	6	50,000 U.	6	—	—
"	6	100,000 U.	5	1	—
"	6	125,000 U.	5	1	—
"	6	50,000 U.*	3	3	—
		in 0.5 ml. c			
		adrenalin 1 : 1,000			
Streptomycin ..	6	250 mg.	5	1	—
Neomycin	6	100 mg.	6	—	—
Controls	8		—	—	8
Polymyxin B. ..	8	50,000 U.	8	—	—
Streptomycin ..	8	250 mg.	8	—	—
Neomycin	8	500 mg.	8	—	—

(b) *B. proteus*

Infecting dose : 0.05 ml. suspension of *B. proteus* 431 at a concentration equivalent to 1 in 5 dilution of Brown opacity tube No. 3.

Infection by Anterior Chamber Inoculation

	No. of rabbits	Dose : 2 subconjunctival injections each containing :	Result		
			Controlled	Partial control	Uncontrolled
Controls	6		—	—	6
Polymyxin B. ..	6	50,000 U.	—	—	6
Streptomycin ..	6	250 mg.	—	2	4
Neomycin	6	100 mg.	—	2	4
Controls	8		—	—	8
Streptomycin ..	8	500 mg.	2	4	2
Neomycin	8	500 mg.	1	3	4

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Pre-Treatment with Neomycin

One hour before inoculation into A.C. rabbits received 500 mg. Neomycin subconjunctivally; a second subconjunctival injection was given 24 hours later.

	No. of rabbits	Dose: 2 subconjunctival injections each containing:	Result		
			Controlled	Partial control	Uncontrolled
Controls	4		—	—	4
Treated	8		6	2	—

Infection by Intracorneal Inoculation

	No. of rabbits	Dose: 2 subconjunctival injections each containing:	Result		
			Controlled	Partial control	Uncontrolled
Controls	6		—	—	6
Polymyxin B. ..	6	50,000 U.	—	—	6
Streptomycin ..	6	500 mg.	4	1	1
Neomycin	6†	500 mg.	5	—	—

* Local irritation precluded a second subconjunctival injection.

† One animal died during the course of the experiment.

adequate experimental lesion with gram negative organisms other than *Ps. pyocyanea*. Inoculation with *Ps. pyocyanea* on to the cornea gives a rapidly destructive lesion, which serves very well for experimental evaluation of the efficacy of agents; it has been used to establish the efficacy of streptomycin in such infection (Sorsby, 1950; Sorsby, Ungar and Bailey, 1952), and of polymyxin B. (Ainslie and Smith, 1952; Ainslie, 1953). Other gram negative organisms do not, however, produce a satisfactory lesion in the cornea, and special techniques had to be used.

Corneal infections due to Ps. pyocyanea

Table III (a) shows that neomycin subconjunctivally in doses of 100 mg. and of 500 mg., proved effective in controlling *Ps. pyocyanea* infection of the cornea; the results were of the same order as given by streptomycin 250 mg. subconjunctivally, and by polymyxin used in doses of 50,000 units. In the course of these observations it was found that polymyxin B in such doses was both adequate and well tolerated; tolerance was not good with doses of 100,000 and 125,000 units, whilst the addition of adrenalin to polymyxin used in a dose of 50,000 units reduced the incidence of recovery and gave considerable local irritation.

B. proteus infection

Seeing that *B. proteus* does not "take" in the cornea, it was introduced into the anterior chamber and an attempt was made to assess the efficacy of neomycin, as compared with streptomycin and polymyxin B. As can be seen from Table III (b), polymyxin was entirely ineffective, whilst both

streptomycin and neomycin in doses of 500 mg. were only slightly better. The infection in fact was fulminating. That neomycin is none the less of value in such infection was shown by pre-treatment of infected animals. Once a fulminating infection was prevented by adequate pre-treatment, six out of eight treated animals recovered. Less fulminating infections could also be obtained if the *B. proteus* was introduced intracorneally, after the technique described by Robson (1944). Six control animals did uniformly badly, as did six animals treated with polymyxin B.; in contrast, the results with streptomycin and neomycin were adequate.

4. Neomycin in infections due to penicillin-sensitive organisms

Table IV records experiments to assess whether neomycin was also effective against the common penicillin-sensitive organisms. It will be seen that neomycin subconjunctivally in doses of 0.5 g. with adrenalin gave results of the same order as penicillin 500,000 units with adrenalin when infection was established by anterior chamber inoculation with streptococcus haemolyticus, *D. pneumoniae* and staphylococcus aureus.

TABLE IV
INFECTION WITH PENICILLIN SENSITIVE ORGANISMS
NEOMYCIN COMPARED WITH PENICILLIN

Both agents given subconjunctivally dissolved in 0.75 ml. of water and 0.25 ml. adrenalin 1 : 1,000. Two injections at 2 hours and 24 hours after infection given for streptococcal and pneumococcal infections, and a third injection at 48 hours for experiments with staphylococcus.

Infecting doses : 0.05 ml. of an overnight culture $2,000 \times 10^6$

Serial numbers of infecting organisms : 618, 156E and 663 respectively.

1. STREPTOCOCCUS HAEMOLYTICUS

	No. of Rabbits	Dose per subconjunctival injection	Results					
			Very Good	Good	Fair	Poor	Very Poor	Died
Controls	8		—	—	—	—	8	—
Penicillin	8	500,000 U.	6	—	2	—	—	—
Neomycin	8	500 mg.	5	—	1	—	1	1

2. D. PNEUMONIAE

Controls	8		—	—	—	—	8	—
Penicillin	8	500,000 U.	1	5	2	—	—	—
Neomycin	8	500 mg.	5	—	—	—	3	—

3. STAPHYLOCOCCUS AUREUS

Controls	4		—	—	—	—	4	—
Penicillin	8	250,000 U.	2	2	—	1	3	—
Neomycin	8	500 mg.	4	3	—	—	1	—

5. Optimum methods

As dosage and frequency of application are determined by the intra-ocular concentration reached by the highest tolerated dose by subconjunctival injection, assessment was made of the concentrations reached and maintained in the ocular tissues of the rabbit after the administration of a subconjunctival dose of 0.5 g. neomycin sulphate. It will be seen from

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Table V, a considerable level of concentration is reached by four hours, and is well maintained for sixteen hours, with possibly therapeutic levels for at least twice as long. The addition of adrenalin appears to increase the initial levels—those seen during the first sixteen hours—but does not appear to have any marked effect on concentration subsequently. Adrenalin, therefore, does not influence the intraocular levels of neomycin as definitely as those of penicillin and streptomycin, but it is still of value. For clinical purposes neomycin subconjunctivally should therefore be used in doses of 0.5 g. dissolved in 0.75 ml. of water to which 0.25 ml. of adrenalin 1 : 1,000 has been added.

TABLE V
OCULAR CONCENTRATION OF NEOMYCIN ($\mu\text{g./ml.}$ or $\mu\text{g./g.}$) AFTER SUBCONJUNCTIVAL INJECTION OF 0.5g. IN 1 ml. OF WATER OR 0.75 ml. OF WATER AND 0.25 ml. OF ADRENALIN 1 : 1,000

		Hours after injection													
		4		7½		16		24				30		48	
Eye No. :		1	2	3	4	5	6	7	8	9	10	11	12	13	14
<i>Neomycin in aqueous solution</i>															
Aqueous		290	180	120	180	470	2800	270	190	83	100	30	17	22	14
Vitreous		48	18	24	36	58	50	80	56	40	39	29	15	20	9
Cornea		330	75	30	12	12	52	16	14	21	35	11	10	<3	<3
Anterior tissues .		960	260	810	24	33	200	63	20	23	20	11	60	11	24
Posterior tissues .		900	230	450	140	34	470	320	15	22	14	9	290	6	66
Eye No. :		15	16	17	18	19	20	21	22			23	24	25	26
<i>Neomycin in aqueous solution with adrenalin</i>															
Aqueous		5000	4300	470	420	800	700	135	198			153	429	207	50
Vitreous		725	490	525	21	3400	1000	50	126			40	27	21	32
Cornea		195	126	165	52	20	13	31	7			570	33	150	<3
Anterior tissues .		1500	2050	530	550	63	42	105	22			76	87	24	10
Posterior tissues .		1750	2350	205	260	37	40	153	12			129	74	35	32

6. Clinical possibilities

Clinical experience with the use of neomycin subconjunctivally is as yet scanty. Clinical trials have shown that 0.5 g. neomycin in 0.75 ml. water, to which 0.25 ml. adrenalin 1 : 1,000 has been added, is well tolerated, and that at least four repeated injections can be given at intervals of twenty-four hours without undue discomfort or toxic effects.

Neomycin in this concentration and vehicle has been used as subconjunctival injections at intervals of twenty-four hours over three to four days in four cases as a last resort when other antibiotic treatment had failed. Neomycin also failed, but the conditions of the test were such that the failure must be ascribed to an uncontrollable process rather than to an inefficacy of the drug. In the one case treated with neomycin from the beginning—a case of hypopyon ulcer with bacterologically sterile conjunctiva but with clinical appearances suggestive of a gram negative bacillary infection—rapid resolution occurred. Two injections at intervals of twenty-four hours sufficed. Likewise, neomycin controlled within twenty-four hours a case of hypopyon following a perforating injury; here

neomycin was begun within forty-eight hours of the injury, one injection of penicillin having meanwhile proved ineffective; in this case, too, no organisms were recovered in smear and culture.

It is tempting to think of neomycin treatment on these lines as a standard method of treatment to-day for infected eyes. Two reasons determine this choice. In the first place—as already pointed out—the widespread use of penicillin in ointment or drops has made intraocular infection a relatively rare event to-day, and when intraocular infection is seen the case generally represents failure of penicillin as a prophylactic; it is therefore likely that the infection is due to a penicillin-resistant organism, and that there will be no therapeutic response either. Secondly, neomycin is indeed a broad spectrum antibiotic for the ophthalmologist. It is effective, not only against gram negative bacilli like *Ps. pyocyanea* and *B. proteus*, but also against penicillin-resistant staphylococcus aureus, and in addition is also effective against the organisms for which penicillin is normally specific, such as staphylococcus aureus, streptococcus and pneumococcus. The use of neomycin in any particular case before the nature of the causative organism is established is therefore justified as a first measure, and in many cases it is likely to be the only measure needed. There is nothing in the experimental results to suggest that any of the other available antibiotics with more limited action are better therapeutic agents than neomycin. The use of penicillin, streptomycin, or polymyxin may be dictated by sensitivity tests showing one or other of these agents to be especially effective against the organism in any particular case, but it is unlikely that such occasions will be frequent.

Three further considerations arise: (1) Neomycin is a highly toxic substance and is not used systemically. Subconjunctival injections are a form of systemic administration and are therefore to be used sparingly. There is no reason to assume that doses of a total of up to 2 grams are dangerous; (2) In recent years various antibiotics with special indications such as polymyxin and bacitracin, have been used as ointments instead of penicillin as a routine procedure in out-patient practice. This is to be deprecated, because the limited efficacy of these agents may well allow the development of an infection which penicillin with its action on the more common organisms would have prevented. If penicillin should continue to be used as the standard prophylactic agent the clinician meeting a case of infection will have a fairly clear intimation that he is dealing with a penicillin-resistant strain. If other agents are used, not only is the high value of penicillin as a prophylactic agent denied to the patient, but the nature of any resultant infection is far from clear; (3) The high solubility of neomycin makes it possible to use fairly high concentrations of the ointment and the local tolerance to such ointment is apparently good. It is therefore possible that neomycin as a standard procedure in out-patient use might be even more effective than penicillin as a prophylactic. For the present there is no evidence on this point. Likewise, there is no evidence

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at the moment as to the possible emergence of neomycin-resistant strains of organisms normally susceptible to the drug. Whatever may ultimately prove to be the place of neomycin as a prophylactic, it has considerable potentialities as a therapeutic agent in the ocular infections seen to-day.

SUMMARY

1. Attention is drawn to the changed character of ocular infections seen to-day. The widespread use of penicillin drops and ointment has prevented the development of ocular infections due to penicillin-sensitive organisms. In consequence a high proportion of ocular infections to-day are due to penicillin-resistant strains of staphylococcus aureus or to gram negative bacilli insensitive to penicillin. There is, therefore, a need to-day for an agent which is effective for these types of infection, for penicillin in these cases gives no result.

2. In rabbits with intraocular infections induced by penicillin-resistant staphylococcus aureus, preliminary trials led to the exclusion of magnamycin and bacitracin because of inefficacy; erythromycin and neomycin were the only agents that showed any promise.

3. Soluble erythromycin salts administered in subconjunctival injection gave better results than oral administration of the drug, but the injections were not well tolerated. Subconjunctival injection of neomycin in doses of 500 mg., proved both well tolerated and effective against three strains of penicillin-resistant staphylococcus aureus.

4. Neomycin subconjunctivally also proved effective against corneal infection due to *Ps. pyocyanea*, the results being of the same order as those obtained with streptomycin or polymyxin B.

5. Neomycin subconjunctivally did not control an intraocular infection produced by inoculating *B. proteus* into the anterior chamber; the infection ran a fulminating course. Control was, however, obtained when the animal was pre-treated with neomycin subconjunctivally one hour before inoculation, or when the infection was introduced by intracorneal inoculation.

6. Neomycin subconjunctivally proved as effective as penicillin for the treatment of intraocular infections produced by pneumococcus, by streptococcus haemolyticus, or by penicillin-sensitive staphylococcus aureus. In these observations adrenalin was added to the solution of both agents.

7. Assessment of corneal and intraocular levels of concentration reached by subconjunctival injection of 0.5 g. neomycin showed that high levels are reached for sixteen hours and therapeutic levels persisted for probably twenty-four hours. The addition of adrenalin to the solvent increased the initial levels markedly, but had no such effect on concentrations subsequently.

8. Clinical trials have established that neomycin in doses of 0.5 g. in 0.75 ml. of water and 0.25 ml. of adrenalin 1 : 1,000 are fairly well tolerated

and can be repeated at twenty-four hourly intervals three or four times without marked discomfort or toxic effects.

9. Clinical experience with such administration are as yet limited. It is likely that neomycin so used is a satisfactory standard method of treatment of the intraocular infections seen to-day, for such treatment should prove effective against the whole range of organisms met in ocular infections—penicillin-sensitive staphylococcus aureus, pneumococcus, streptococcus, penicillin-insensitive staphylococcus aureus, and the penicillin-insensitive gram negative bacilli.

We are indebted to Dr. P. Muggleton for his interest and help, and to Mr. B. Helliwell for painstaking technical assistance. We are obliged to Messrs. Upjohn of England, Ltd., for supplies of neomycin, to Messrs. Burroughs Wellcome & Co., for polymyxin B., and to Messrs. Abbott Laboratories for erythromycin. Messrs. Pfizer, Ltd., have been most generous with supplies of neomycin and other antibiotics greatly facilitating the work recorded.

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THE FOLLOWING GENEROUS donations have been received during the last month :

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£100	Mary Ponsonby

SURGICAL CONSIDERATIONS OF THE TEMPORAL LOBES

**A clinical report based on a study of fifty-six verified localised lesions
of the temporal lobes**

An Arnott Demonstration delivered at the Royal College of Surgeons of England
on
25th April 1957
by

B. D. Wyke, M.B., B.S.

The Department of Applied Physiology, Royal College of Surgeons of England and
The Neurosurgical Centre, Brook Hospital, Woolwich

IN 1885 JAMES ARNOTT, F.R.S., endowed a series of lectures to be given at the Royal College of Surgeons, in connection with the contents of its Museum. But in 1908 the College instituted a group of lectures on problems of Advanced Surgical Pathology, and both the Arnott and Erasmus Wilson endowments were then directed to this purpose. Thereafter, it became the custom for the Erasmus Wilson Demonstrators to relate their remarks to the contents of the Pathological Museum while the Arnott Demonstrators confined their attention to problems relating to material in the Anatomy Museum. It is not surprising, then, to find that most Arnott Demonstrators since 1908 have been professional anatomists, or surgeons concerning themselves with descriptive anatomical problems.

However, last year this custom was broken by election of a professional physiologist to this post—evidence, I hope you will agree, of that enlightened attitude, so clearly displayed by John Hunter, which refuses to recognise any dichotomy between considerations of structure and function, at least so far as surgery is concerned. It is, I hope, a further result of that attitude that gives me the opportunity of addressing you to-day. Believing this to be so, I have chosen a subject which, in addition to its immediate clinical interest, clearly exemplifies the impossibility of disentangling anatomical from physiological problems in surgical practice. For these reasons, then, I propose to discuss some aspects of disordered temporal lobe function* as they are encountered in a neurosurgical clinic.

CLINICAL MATERIAL

The clinical material on which this survey is based is drawn from cases passing through my hands at the Neurosurgical Centre of the South-East Metropolitan Region. And before I proceed, I should like to acknowledge the cooperation of my surgical, pathological and radiological colleagues at this Centre in making the study possible.

In the three years ending in December 1956, 1,882 cases of nervous disorders of all types were seen in my unit. Some 12 per cent. of them (226 cases) displayed electroencephalographic evidence of disordered temporal lobe function as a basis for their symptomatology; and in almost

*An excellent review of earlier work on this subject is contained in the monograph edited by Alajouanine (1955).

one quarter of these cases the anatomical and pathological features of a causative lesion have by now been demonstrated with a precision sufficient to make them worth detailed study. I am thus able to present to you a selected group of fifty-six cases of localised lesions of one or other temporal lobe, thirty of them being in the left hemisphere and twenty-six in the right.

These particular cases were chosen from the total series for several reasons. First, in each of them the anatomical location of the lesion has been determined as accurately as possible at operation or autopsy. Second, the pathology of each lesion has been clearly established; and third, each lesion is relatively small in extent—for all cases in which diffuse pathological changes were, or might have been, present have been eliminated from this series. In this way we can consider the abnormalities produced by known lesions largely confined to the anterior, middle and posterior thirds of the temporal lobe in terms of the light they may throw on the functions of individual parts of this region of the brain.

To this end the temporal lobe†—whose antero-posterior length in the adult human brain averages 11 to 12 cm.—has been arbitrarily divided into three segments of equal length; and in each of the fifty-six cases that I have selected the lesion lies wholly, or almost entirely, within one of these three segments. Cases with lesions overlapping markedly from one of these artificial subdivisions into another have not been included in this report. This was done in the hope that comparison of the symptoms and signs displayed by acute and chronic, destructive and irritative lesions in these three areas might indicate differential functions possessed by different parts of the temporal lobe, distinct from the functions they possess in common. The lesions in the majority of these cases extend for varying distances into the substance of the temporal lobe to involve its internal structures from lateral or inferior aspects; but a few cases are included, for purposes of comparison, in which the lesion involves the lobe from its medial, antero-superior or postero-superior aspects.

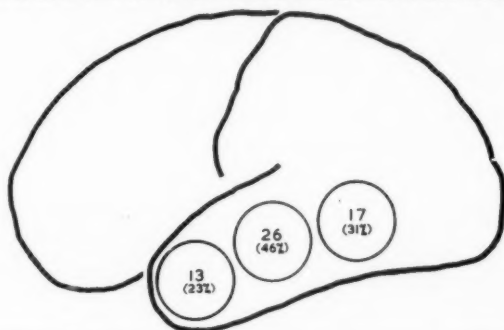
In this series then, 23 per cent. of the cases had lesions in the anterior temporal segment, 46 per cent. had lesions involving the middle segment, and 31 per cent. had lesions in the posterior segment (Fig. 1). Of the thirteen cases with anteriorly situated lesions six were neoplasms, one was a superficial cortical laceration that was replaced by a glial scar, three were abscesses, two of which were replaced after treatment by glial cicatrices, and the remaining three scars followed old head injuries. Twenty-four of the twenty-six mid-temporal lesions were abscesses, ten of which were followed by cicatrices after treatment; one was a small solid subdural haematoma compressing the temporal lobe; and one was an old post-traumatic scar. There were twelve abscesses in the posterior temporal

†For the purposes of this communication, the temporal lobe is considered to extend from the temporal pole anteriorly, posteriorly to the plane joining the end of the Sylvian fissure to the pre-occipital notch.

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segment, nine of which were followed by cicatrices after treatment ; one scar was the result of an earlier head injury ; and the remaining scar was the result of gliosis in a previous small infarct ; there were also three neoplasms in this segment, making a total of seventeen cases with posteriorly situated lesions. The high proportion of intracerebral abscesses in this series of cases is explained by the fact that I regard them as particularly useful lesions for a study of this kind. For when they become encapsulated in the early stages (Fig. 2a) they generally constitute well-localised lesions whose anatomical location is readily determined radiologically and surgically ; while in patients who recover after treatment

DISTRIBUTION OF LOCALISED LESIONS IN THE TEMPORAL LOBES IN FIFTY-SIX SELECTED CASES



Segment	No. of Cases	Pathology	Remarks
Anterior	13	Neoplasms 6 Abscesses 3 Scars 6 Laceration 1	1 scar followed the laceration 2 scars followed treated abscesses 3 scars followed old head injuries
Middle	26	Neoplasms 0 Abscesses 24 Scars 11 Subdural haematoma 1	10 scars followed treated abscesses 1 scar followed an old head injury
Posterior	17	Neoplasms 3 Abscesses 12 Scars 11	9 scars followed treated abscesses 1 scar followed an old head injury 1 scar followed an infarct
TOTAL	56	Neoplasms 9 Abscesses 39 Scars 28 Laceration 1 Subdural haematoma 1	21 scars followed treated abscesses 6 scars followed head injuries 1 scar followed an infarct

Fig. 1. Distribution of localised lesions in the three segments of the temporal lobe. The figures apply to lesions on both sides of the brain, although depicted only for the left hemisphere. The pathology of the lesions is listed in the table. It will be noted that seventy-eight lesions were present in the fifty-six cases, as in some cases a patient was studied both with an acute lesion (laceration or abscess) and with a chronic lesion (replacement scar).

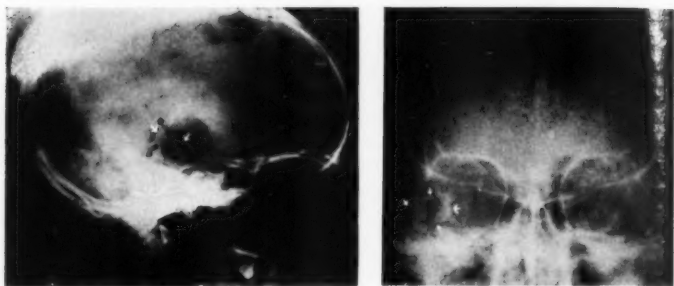


Fig. 2(a). Lateral and anterior radiographs showing a superficial right mid-temporal abscess complicating right otitis media, at the beginning of treatment. The patient was drowsy and confused, with a left homonymous hemianopia, weakness of the jaw muscles on the right and of the facial muscles on the left, and with a flaccid left hemiparesis most marked in the hand and forearm. During treatment he had several episodes of focal motor *status epilepticus*, involving the muscles of the left lower face and left upper limb. Weakness of the left leg recovered first, then the left arm. The left facial paresis and homonymous hemianopia were still present on discharge.

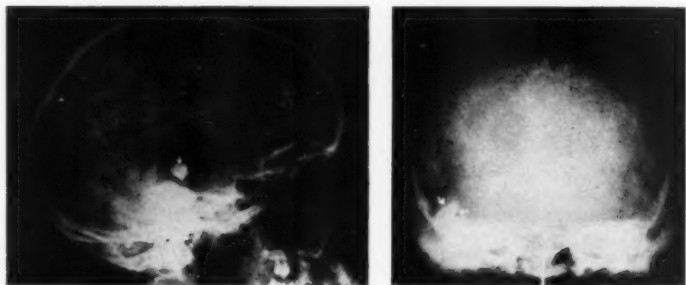


Fig. 2(b). Lateral and anterior radiographs showing the contracted cicatrix five months after completion of treatment, in the same case. For two months after discharge the patient had been irritable, aggressive, and emotionally labile. At the time these films were taken his mental state was normal, and the only residual disability was a left homonymous hemianopia. There were no further seizures.

the abscess is replaced by a glial scar (Fig. 2b) that frequently irritates the neurones at its borders (see Penfield and Jasper, 1954; Northcroft and Wyke, 1957), thus constituting a localised irritant of known location within a small sector of cortex.

ANALYSIS OF SYMPTOMS

This material has been reviewed in detail from the point of view of the relation between symptomatology and site of the lesion, and in the light of recent anatomical and physiological studies of the temporal lobes and their connections; but in this lecture I propose to confine myself to certain aspects that are of special surgical interest.

Mental disturbances

Of particular significance to surgeons are the mental disorders which are the commonest consequence of a temporal lobe lesion. Such disturbances were present in almost three-quarters of the present group of cases, often as the initial presenting symptom; and on this account many of them were seen in the first instance by a psychiatrist, or by the police.

For example, three of these patients were charged with attempted murder, one of them after attempting suicide following an unsuccessful homicidal attack on his wife and child. Others of them were picked up by the police after being reported missing from home, or because of peculiar behaviour in public; while still others were referred to psychiatrists because of a variety of personality changes, as a result of which some received electroconvulsive therapy or were referred to us with a recommendation for leucotomy. Thus one woman, with a 30 ml. abscess in the middle third of her right temporal lobe, received ten electroshocks—and only her failure to regain consciousness after the last treatment led to her referral to a neurosurgical unit. Another patient, a man aged forty-seven, suddenly deserted his wife and went to live with a seventeen-year-old girl. Two years later he was traced by the police, arrested and committed to prison for failing to comply with a maintenance order. Shortly afterwards he began to see butterflies flying off the tips of his fingers, and he spent long hours searching for a frog in the bed in his cell. Eventually his behaviour became so bizarre that he was about to be certified; but by the time of his examination for this purpose he had developed extensor plantar responses, which led to his referral. This man was found to have an astrocytoma in the anterior third of his right temporal lobe.

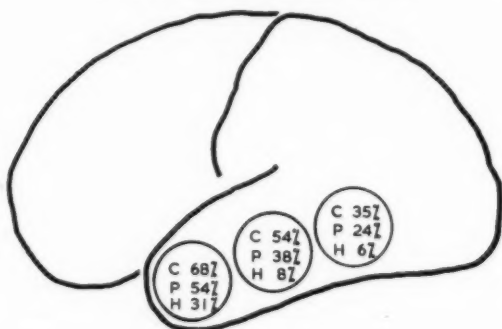
The particular mental disorders displayed by these patients (*cf.* Hécaen and Ajurriaguerra, 1956) can be classified roughly into a few broad categories (Fig. 3), in order to illustrate some of the differences that exist with lesions in the three segments of the temporal lobe. More precise classification would require detailed consideration of the results of formal psychological investigation (see Milner, 1954; Meyer and Yates, 1955; Ervin, *et al.*, 1955; Quadfasel and Pruyser, 1955)—but for present purposes this is not necessary.

The first and most ubiquitous disturbance (Fig. 3) is a *confusional state*. This was most often seen with anterior temporal lesions, occurring in just over two-thirds of such cases. It was seen in a little more than half of the cases with mid-temporal lesions, and in only about a third of the posterior lesions. With chronic lesions this disturbance begins insidiously, the patient gradually becoming confused over details of his work or the identity of his friends. He becomes forgetful of where he puts familiar objects, and loses his personal belongings. Then he becomes uncertain of the passage of time or of where he lives, and finally is completely disorientated in time and place. With acute lesions, such as a rapidly developing brain abscess, the process evolves quickly so that within twelve hours

or so a perfectly normal man may be completely disorientated in every respect.

Second, and slightly less frequent than this confusional state, are a variety of *personality changes* (Fig. 3), ranging from emotional lability or irritability to homicidal violence or a deluded schizoid state (*cf.* Ervin, *et al.*, 1955; Hécaen and Ajurriaguerra, 1956). This type of disorder is again conspicuously associated with anterior temporal lesions, occurring in over half of the present group in comparison with some two-fifths of the mid-temporal cases and one quarter of the posterior temporal cases. Aggressive behaviour towards other people—often involving physical attacks on them—is an especially prominent feature of the personality disorder associated with anterior temporal lesions (*cf.* Williams, 1956); and in the present series only one such patient with personality changes did not display it. In contrast, aggressiveness was manifest in but one quarter of the cases with mid-temporal lesions, and in only two patients with posterior lesions.

REGIONAL INCIDENCE OF CATEGORIES OF MENTAL DISORDER IN FIFTY-SIX SELECTED CASES OF LOCALISED TEMPORAL LOBE LESIONS



Category of mental disorder	Incidence in segment of temporal lobe		
	Anterior	Middle	Posterior
Confusional state (C)	9 cases	14 cases	6 cases
Personality changes (all) .. (P)	7 cases	10 cases	4 cases
Aggressiveness (H)	6 cases	6 cases	2 cases
Hallucinations (H)	4 cases	2 cases	1 case

Fig. 3. The incidence of certain categories of mental disorder in patients with lesions in the three segments of the temporal lobe, expressed as a percentage distribution in the diagram. The actual numbers of cases are given in the table.

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One patient, a boy of fourteen with an astrocytoma in the anterior segment of his right temporal lobe, smashed up the furniture in his home to the extent of about £200 worth of damage and attempted to throttle his grandmother, as a result of which he was arrested and certified. Another man, a thirty-seven-year-old civil engineer with a chronic right anterior temporal abscess, several times attempted to strangle other patients in his ward; and on another occasion he trapped a nurse in a corner and tried to strangle her with the cord from a window curtain. It is relevant to my theme to point out here that removal of the tumour (Fig. 4) in the first of these cases, and treatment of the abscess in the second, have restored both these patients to mental normality for three years in the one, and for two years in the other case; and both are now gainfully employed.

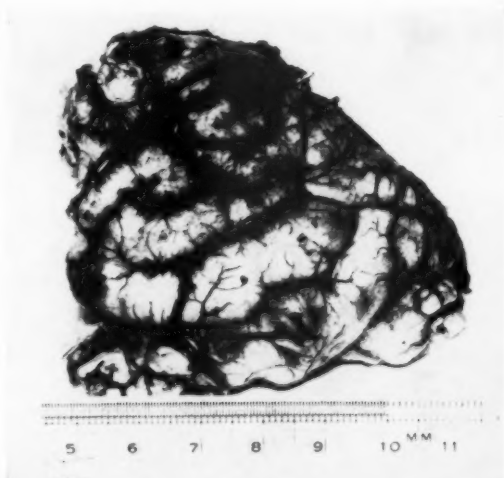


Fig. 4. The resected portion of the right temporal lobe from the boy, described in the text, who attacked his grandmother and attempted to destroy his home. The marked vertical expansion of this portion of the temporal lobe is produced by an astrocytoma (Grade III) within it.

Without going into the details here, I want to suggest that it is possible that this specific association between aggressive behaviour and lesions anteriorly situated in the temporal lobe might be related to their involving the amygdaloid nucleus or its connections, within the anterior temporal segment. For similar behavioural changes can be induced in animals by experimental interference with the amygdaloid nuclei—thus, their stimulation with implanted electrodes in unanaesthetised animals (see Gastaut, *et al.*, 1951; Kaada, *et al.*, 1954; Penfield and Jasper, 1954; Shealy and Peele, 1957) converts a placid animal into an aggressive savage; while

bilateral destruction of these same nuclei in monkeys converts an aggressive domineering animal into a tame, submissive character (Schreiner and Kling, 1953 ; Rosvold, *et al.*, 1954), as illustrated in Fig. 5.

A third, and equally striking type of mental disturbance encountered in temporal lobe lesions (see Hécaen and Ajuriaguerra, 1956) is the occurrence of a variety of *hallucinatory experiences* (Fig. 3). These were four

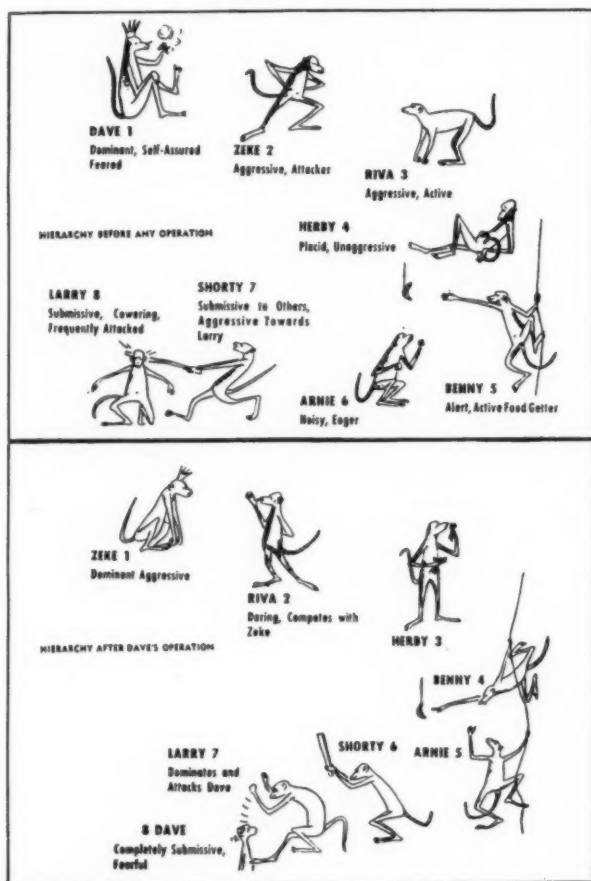


Fig. 5. The effect of bilateral destruction of the amygdaloid nuclei on the hierarchical position of the subject in a colony of monkeys (from Rosvold, *et al.*, 1954). Prior to the operation the animal DAVE was the leader of the colony; but subsequently he became its least effective member, lacking his initial drive and assurance and being subservient to all his associates.

times as frequent in patients in this series with anterior temporal lesions, as they were with the mid-temporal and posterior temporal lesions; and in the former site usually consisted of visual illusions or hallucinations. These ranged from a simple experience of increasing intensity of illumination, through apparent increase or decrease in the size of objects being viewed, to more complex subjective experiences—such as the appearance of a coach drawn by little dogs which one patient, with a right anterior temporal astrocytoma, described as coming from behind him on his right and landing on his right forearm. Gustatory and olfactory hallucinations were rare in this series of cases; but both occurred, for example, in one patient with a post-traumatic scar involving the anterior and medial aspects of his right temporal pole. The comparative rarity of this type of disturbance in the present series is explained, I think, by the fact that I have deliberately selected lesions which, for the most part, are confined to the lateral surface of the temporal lobe; for my experience, like that of others, has been that hallucinations of taste and smell are generally associated with lesions involving the antero-medial aspects of the temporal lobe¹, as in the case just cited.

With mid-temporal lesions, visual hallucinations may again occur—but such experiences are here much less frequent than in the cases with anteriorly situated lesions. One such case may be mentioned as an example—this was a man with a mid-temporal scar following treatment of a brain abscess, who periodically saw a man's face surrounded by a ring of candles which flared up, and then died away.

Auditory hallucinations were rare in this series of cases, occurring in but two cases with anteriorly situated lesions and in one with a mid-temporal lesion; none occurred in patients with lesions in the posterior temporal segment. Further, in each of these cases the auditory experience was always associated with visual hallucinations, which followed immediately on the auditory hallucination (*q.v.*).

All the hallucinatory experiences referred to here occurred unassociated with other seizure phenomena, although they were of course themselves ictal experiences. Those hallucinations which were experienced as prodromata in a seizure sequence are considered later (*q.v.*), in this connection.

With these facts in mind, it seems hardly necessary to stress the variety and severity of the mental disorders that may herald and accompany lesions of the temporal lobes; but nonetheless, the frequency of this association is only gradually becoming apparent in psychiatric and medico-legal circles, although its significance in these fields is obvious. Furthermore, it is important to note that where the lesion is recognised in time for adequate neurosurgical treatment, the mental disorders associated with it may often be abolished or alleviated thereby (*cf.* Penfield and Flanigin, 1950; Bailey, 1954; Falconer, *et al.*, 1955; Picaza and

¹In this connection it should be noted that experimental studies on primates (*e.g.*, Meyer and Allison (1949); Kaada (1951); Adey and Meyer (1952)) indicate that the primary olfactory projections are confined to antero-medial structures in the temporal lobe.

Gumá, 1956). For example, of the forty-two patients in this series who had mental disorders of some type or other, twenty-seven are still alive; and only three of these are not living normally at home, or working.

Because of the importance of early recognition and segregation of patients with mental disorders due to temporal lobe lesions from those not having such lesions, in spite of the fact that many of the former cases may have no abnormal physical signs initially, I want to put in a plea for more widespread application of electroencephalography to this end, and especially for recording during progressive barbiturate narcosis (see Wyke, 1950, 1951). This is not the place to deal with this aspect of the problem—but I think it is relevant to point out here that with this technique the lesion was correctly located anatomically in every one of the cases in this series; and that in nearly three-quarters of them its pathological nature was accurately identified prior to other investigations².

Somatic seizures

In addition to mental disorders, another symptom complex of great physiological interest that is frequently associated with lesions of the temporal lobes consists of a variety of seizure phenomena (see Penfield and Kristiansen, 1951; Penfield and Jasper, 1954). These range from generalised convulsions with loss of consciousness, through focal seizures of various types to brief disturbances of consciousness of which even the patient himself may be unaware. Of course, any one patient may experience a variety of these seizure phenomena in the course of his illness, especially with progressive lesions; and it may be worth pointing out here that marked variability of the seizure spectrum in individual cases seems to be more particularly associated with lesions of the temporal lobes than with lesions of similar pathology in other parts of the brain.

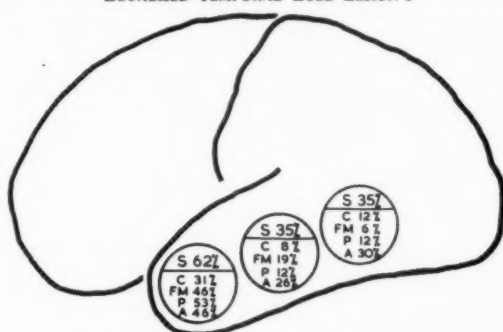
In general, seizure phenomena of all types are more frequent with anterior temporal lesions (Fig. 6), occurring here almost twice as often as with middle and posterior temporal lesions. In the present series of cases, for example, seizure phenomena were present in almost two-thirds of the anterior temporal cases, in comparison with just over one-third of the mid-temporal and posterior temporal cases.

There are also striking differences as between the three temporal regions, when the relative incidence of particular categories of seizures is considered (Fig. 6). Thus *generalised convulsions* are most frequent with anterior temporal lesions, but are next most frequent—occurring just under half as often—with posterior temporal lesions; their incidence in mid-temporal lesions is only one quarter of that in the anterior temporal lesions. However, the incidence of generalised convulsions in the series as a whole is not great, being about 14 per cent.; and as this figure lies within the proportion of the population at large with a convulsive predisposition, it indicates that there is no particular association between lesions of the temporal lobe and the occurrence of generalised seizures.

²This latter score is of course biased by the high proportion of abscesses in this selected group of cases.

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REGIONAL INCIDENCE OF SOME SEIZURE PHENOMENA IN FIFTY-SIX SELECTED CASES OF LOCALISED TEMPORAL LOBE LESION S



Seizure category	Incidence in segment of temporal lobe		
	Anterior	Middle	Posterior
All types (S)	8 cases	9 cases	6 cases
Generalised convulsions (C) . .	4 cases	2 cases	2 cases
Focal motor seizures (FM) . .	6 cases	5 cases	1 case
Psychical seizures (P)	7 cases	3 cases	2 cases
Autonomic seizures (A)	6 cases	7 cases	5 cases

Fig. 6. The incidence of various seizure phenomena in patients with lesions in the three segments of the temporal lobe, expressed as a percentage distribution in the diagram. The actual numbers of cases are given in the Table.

But this is not the case when other types of seizures are considered. Of particular interest in this respect are *focal motor seizures* (Fig. 6), which occurred in about one quarter of the present group of cases. Further, the regional incidence of these seizures falls off directly in an antero-posterior direction in the temporal lobe; for whereas focal motor seizures occurred in almost one half of the cases with anterior temporal lesions, they were present in only one-fifth of the mid-temporal cases, and in but a single case with a posterior lesion. These observations are of considerable physiological significance, for they supplement previous experimental and clinical data (*e.g.*, Mettler, 1935; Dusser de Barenne, *et al.*, 1941; Walberg and Brodal, 1953; French, *et al.*, 1956; Wyke, 1957) indicating that in primates the temporal cortex contributes appreciably to the motor projection systems. And might I repeat here that in none of the cases to which I am referring did the causative lesion involve cortical sectors dorsal

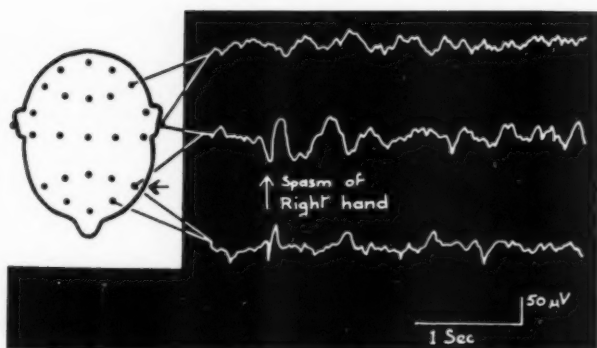


Fig. 7. Portion of an electroencephalogram, obtained during progressive barbiturate narcosis, from a patient with a post-traumatic scar involving the lateral aspect of the anterior segment of the left temporal lobe (confirmed at operation). Discharge of spikes from neurones at the lower border of this scar (at arrow) was associated with a focal motor seizure involving the muscles of the right forearm and hand.

to the Sylvian fissure; and in some of them (Fig. 7), it has been possible to observe electrographically that the occurrence of a focal motor seizure coincided with discharge of spikes or fast waves from irritable foci in the lateral temporal cortex.

Further to these considerations, particular interest attaches to the parts of the body involved in the focal motor seizures displayed by patients with irritative lesions in different parts of the temporal lobe (Fig. 8). The most common phenomenon with anterior lesions was twitching or jerking confined to the muscles of the upper limbs; and it should be noted that this was usually bilateral, involvement of the contralateral arm alone being uncommon. Somewhat less frequent was rotation of the head and/or eyeballs to one or other side, together with twitching of the facial muscles and sometimes chewing movements or movements of the tongue and pharyngeal musculature. In contrast, with mid-temporal lesions movements of the head, eyeballs and facial muscles were rare, and movements of the tongue, jaws and pharyngeal musculature were not observed. Instead, the most frequent phenomenon here was twitching or jerking in the upper limb; but with lesions in this situation the movements were always confined to the contralateral arm, the ipsilateral limb not being involved. Further, in two of these mid-temporal cases the twitching spread to involve the contralateral leg as well—and this seizure pattern was never observed in lesions of the anterior temporal segment. In the only posterior temporal case with focal motor seizures, the somatic ictal phenomena consisted solely of twitching of the muscles in the opposite arm, which spread rapidly into the leg on that side.

Analysis of these phenomena, which result from irritation of cortical

SURGICAL CONSIDERATIONS OF THE TEMPORAL LOBES

neurones in various sectors of the lateral surface of the temporal lobe, suggests that this surface contributes significantly to the corticospinal motor projection system as well as to the reticulospinal system (see Kaada, 1951). It appears (Fig. 9) that there is a considerable population of neurones in the anterior and middle segments of the lobe that influences motoneurones supplying the muscles of the contralateral arm, mixed—in the anterior segment alone—with a smaller group of cells that projects to motoneurone pools of the ipsilateral arm. In addition, aggregated mainly in the anterior segment but with some overlap into the middle segment, there are additional cells projecting to motoneurones in the nuclei of the cranial nerves that supply the extra-ocular muscles, the jaw muscles, the facial muscles, and the musculature of the pharynx and tongue, as well as to motoneurone pools innervating the cervical muscles. Finally, scattered amongst the corticospinal projection neurones that project to contralateral arm motoneurones from the middle and posterior segments of the temporal lobe, there appears to be a small population of cells that influences the motoneurones innervating the contralateral leg.

Muscular pareses

Further support for these suggestions, which are based on a study of the effects of irritation of temporal cortical neurones, is provided by an analysis of the bodily distribution of the paretic phenomena resulting from inactivation of these same neurones by destructive lesions. In this respect, the findings in the present group of cases may be summarised as follows.

REGIONAL INCIDENCE OF FOCAL MOTOR SEIZURE PHENOMENA IN FIFTY-SIX SELECTED CASES OF LOCALISED TEMPORAL LOBE LESIONS

Segment of temporal lobe	Parts involved in seizure phenomena
Anterior	HEAD AND EYEBALLS FACIAL MUSCLES JAW MUSCLES TONGUE AND PHARYNX BOTH UPPER LIMBS CONTRALATERAL ARM
Middle	HEAD AND EYEBALLS FACIAL MUSCLES CONTRALATERAL ARM ↓ CONTRALATERAL LEG
Posterior	CONTRALATERAL ARM ↓ CONTRALATERAL LEG

Fig. 8. The distribution of motor projection systems from the three segments of the lateral temporal cortex, as revealed by analysis of motor seizure phenomena associated with irritative lesion therein. The relative sizes of the letters indicate the relative density of the various projection systems, as indicated by the relative frequency with which the different parts of the body were involved.

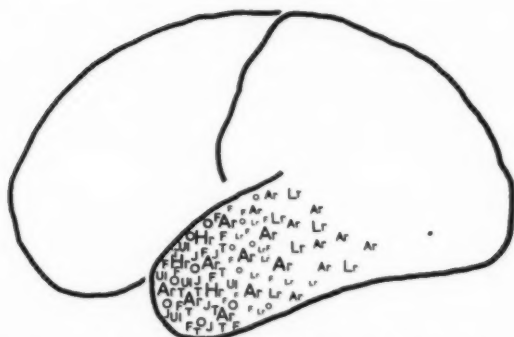


Fig. 9. The topography of the motor projection systems from the temporal cortex, as revealed by comparison of the focal motor seizure with the paretic phenomena associated with lesions therein. The size of the letters indicates the relative density of the various projection systems.

- Hr — contralateral deviation of head
- O — contralateral ocular deviation
- F — contralateral and ipsilateral facial musculature
- J — jaw musculature (ipsilateral)
- T — tongue, palatal and pharyngeal musculature (ipsilateral)
- UI — musculature of ipsilateral upper limb
- Ar — musculature of contralateral upper limb
- Lr — musculature of contralateral lower limb

When such lesions occur in the anterior temporal segment weakness is most often observed in the opposite arm, together with a lesser degree of weakness and clumsiness in the ipsilateral arm. About half as frequent, with such lesions, is impaired or ill-sustained conjugate deviation of the eyeballs (which is often mistaken for nystagmus) and facial weakness, the latter being more marked on the contralateral than on the ipsilateral side. In a smaller number of cases asymmetry of the bite, and weakness of the ipsilateral tongue and palatal musculature are also observed. In passing, it is of interest to note that this clinical picture of pareses involving combined disturbances of corticospinal and cranial nerve functions was frequently considered indicative of a lesion in the posterior cranial fossa, particularly when papilloedema was also present.

In patients with destructive lesions in the middle third of the temporal lobe the paretic phenomena are most common and most severe in the contralateral arm, followed by the facial muscles and extraocular muscles, in that order. Occasionally the contralateral leg has been involved as well to produce a hemiparesis, but the lower limb is always less affected than the upper. With such lesions in the posterior temporal segment the only significant paretic phenomenon is a contralateral hemiparesis—but again the arm is always more severely involved than the leg.

With this clinical evidence before us then, evidence which is derived from a comparison of the effects of irritation and of destruction of neurones in the lateral temporal cortex (see Fig. 9), it seems clear that the contributions

of this part of the brain to the corticobulbar and corticospinal motor projection systems (Fig. 9) should receive serious consideration from those physiologists and anatomists interested in the cortical control of movement in primates (*cf.* Wyke, 1957). Further, I would venture to suggest to you that these observations have serious practical implications for many problems connected with the diagnosis and surgical treatment of neurological diseases.

Psychical seizures

In addition to the somatic seizure phenomena, analysis of which has such interesting applications to the problem of the cortical control of movement, patients with temporal lobe lesions may experience a variety of other ictal disturbances (see Penfield and Kristiansen, 1951; Penfield and Jasper, 1954; Williams, 1956; Stevens, 1957) of no less significance for other branches of neurophysiology and anatomy.

Included amongst these are what may be called loosely "psychical" seizures (Fig. 6). These are of two main types in the present group of cases—either *hallucinatory experiences* in the visual, auditory, vestibular, gustatory or olfactory fields; or else episodic disturbances of mood, often associated with varying degrees of altered awareness of the environment. Such phenomena are most frequent as prodromata to somatic seizures of the type that I have already described; but they may sometimes occur in isolation as the total spectrum of a seizure, as indicated earlier in connection with mental disorders.

With the exception of vertiginous, and to a lesser extent auditory hallucinations almost confined to patients with mid-temporal lesions, psychical seizures in general were most frequently associated with anterior temporal lesions in this series of cases, occurring in about half of them. They were rare with lesions elsewhere in the temporal lobe (*cf.* Williams, 1956), being noted in only three of the middle temporal and in but two of the posterior temporal cases in this group.

Examples of the content of ictal visual hallucinations have already been given, and need not be multiplied; while the features of vertiginous¹, gustatory and olfactory hallucinations are well known (see Penfield and Kristiansen, 1951; Penfield and Jasper, 1954) and need no further description here. Ictal auditory hallucinations, in this series always associated with visual experiences in the three cases in which they occurred, usually consisted in the hearing of a voice speaking to the patient from one or other side; although only rarely was the patient able to recount what the voice said to him. One patient, however, said that he always heard a man's voice counting "one . . . two . . . three . . . four . . . five . . ." at which point both his hands began to twitch and he saw a brilliant light shining down on him from above, and on his right. Another patient said he usually heard a baby crying on his right side, following which he saw a boat with six men in it being swamped by a huge wave. These two

¹Vertiginous seizures occurred in four patients in this series of cases—each of them having a lesion in the middle temporal segment.

patients each had post-abscess scars in the middle temporal segment—a third patient with auditory hallucinations had an anterior temporal astrocytoma.

In contrast to the precision of their descriptions of hallucinatory experiences, patients' accounts of their ictal *affective disturbances* are variable in the extreme (see Williams, 1956; Stevens, 1957), influenced as they are by the intellectual, educational and social status of the individual, as well as by the high-level verbal difficulties from which many of these patients suffer (Quadfasel and Pruyser, 1955). Nevertheless, certain features could be clearly identified in the accounts of such disturbances given by the present group of patients, and are worth noting here. Most frequently experienced (*cf.* Penfield and Jasper, 1954; Williams, 1956), especially by patients with anterior temporal lesions, was a feeling of intense apprehension or fear; although two patients with anterior lesions described a feeling of elation, so intense in one case that the patient said he always felt sorry when it ended. Other patients, fewer in number, experienced depression as an ictal disturbance. Furthermore, in all these cases the lesion involved the lateral temporal cortex—so it is clear that ictal affective disorders are not necessarily confined to lesions involving the medial aspect of the temporal lobe, as has sometimes been suggested (see Maclean, 1952, 1955; Macrae, 1954).

Disturbances of awareness of the environment—apart from loss of consciousness—were less common than these emotional changes and consisted (*cf.* Hécaen and Ajuriaguerra, 1956), in three patients with anterior lesions and in one with a mid-temporal lesion, of a feeling of unreality—usually explained by the statement that a normally familiar environment momentarily became unfamiliar. Thus one of these patients said that this made him feel that he was living in a dream; another, that he seemed to be in another world. In only one patient in this series, a man with an antero-medial post-traumatic scar, was the converse *déjà vu* phenomenon noted, in spite of the frequency with which this is stressed in neurological textbooks dealing with the symptomatology of temporal lobe lesions.

Autonomic seizures

Other bizarre types of ictal disturbance were occasionally encountered in this group of cases; but I want to refer here only to one additional group of seizure phenomena—phenomena which may be classified as visceral or autonomic seizures. Although such seizure manifestations are seldom referred to in clinical discussions of temporal lobe symptomatology (*cf.* Stevens, 1957), they were in fact the most frequently encountered of all such phenomena in the present group of cases (Fig. 6); and it is in order to emphasise this point that I have deliberately kept their analysis till last. In actual fact these autonomic seizure phenomena occurred in one-third of the fifty-six patients in this series, and were observed in three-quarters of those patients with seizure phenomena of all types. They were

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present in about half of the cases with anterior temporal lesions, and in between a quarter and a third of the patients with mid-temporal and posterior temporal lesions. With the exception of psychical seizures in patients with anteriorly situated lesions, autonomic disturbances were therefore the most frequently encountered ictal phenomena in relation to lesions in each region of the temporal lobe.

These disturbances may manifest themselves as episodic changes in the activity of the peripheral blood vessels, the heart, the sweat glands and the erector pili muscles; but more frequently they involve the gastro-intestinal tract and the bladder². As with other ictal phenomena they may form part of a complex seizure sequence; but sometimes they may appear in isolation, constituting a pure autonomic seizure. In some of the present cases such autonomic disturbances occurred as the sole initial manifestation of the disease process, and their significance was then rarely appreciated. Thus one boy's illness began with frequent attacks of flushing of the face, followed by extreme pallor; but not until three years later, and after the gradual development of an extremely complex symptomatology in which autonomic phenomena continued to figure prominently, was he found to have a right anterior temporal astrocytoma. In contrast, another patient with a post-abscess scar in the anterior segment of his left temporal lobe began to have attacks of extreme generalised pallor, with tachycardia and dilatation of the pupils, five months after treatment of his abscess; but in his case the significance of this was at once realised and appropriate anticonvulsant treatment instituted, with successful results so far.

The most frequent manifestation of ictal autonomic discharge from all three segments of the temporal lobe, however, was a variety of gastro-intestinal disturbances (*cf.* Gastaut, 1955; Stevens, 1957). These were noted in about one quarter of the anterior and mid-temporal cases, and in almost one-third of the posteriorly situated lesions. Most common was sudden spasm of the stomach and intestine, accompanied by nausea, epigastric or abdominal pain and rigidity of the abdominal wall. This occurred in eleven of the present group of cases, in eight of whom it formed the initial symptomatology and led to admission of the patient into a general surgical ward as an abdominal emergency—and in fact, four of these patients had laparotomies in consequence. Sometimes there is also acute ulceration of the gastric mucosa, with haematemesis: this occurred in two cases, in one of whom the acute ulcer rapidly perforated through the posterior wall of the stomach into the lesser sac. In other cases there may be a sudden increase in intestinal peristaltic activity, with severe diarrhoea, nausea and vomiting; or, on the other hand, there may be acute dilatation of the stomach and bowel, again with vomiting. All of these phenomena were encountered in various individual cases in this series; and some of these unfortunate individuals had repeated experiences

²A comprehensive physiological study of these phenomena in animals is provided by Kaada (1951).

of this type before the appearance of other symptoms or signs led to their referral to a neurosurgical clinic.

Next to these gastro-intestinal disorders in frequency of occurrence was *acute retention of urine*³. This was about as common as the gastro-intestinal disturbances in the group of anterior temporal lesions; and sometimes the two were associated. But in marked contrast is the fact that this type of disturbance occurred in only one case with a mid-temporal lesion, and did not appear at all in association with the posterior temporal lesions. Ictal retention of urine thus seems to be almost exclusively a manifestation of anterior temporal dysfunction, in contrast to the more ubiquitous origin of ictal disturbances of gastro-intestinal function throughout the temporal lobe. Further, in three cases this disturbance formed the presenting symptom of the illness and led to the patient's admission to hospital, although later in the story it recurred in association with various other phenomena already described.

In the past few years anatomical and physiological studies have revealed important projections from parts of the temporal lobe to various nuclei of the hypothalamus (*e.g.* Adey and Meyer, 1952; Gloor, 1955, 1957); and direct stimulation of structures in the anterior temporal segment (Maclean, 1952, 1954; Chapman, *et al.*, 1954; Anand and Dua, 1956; Passouant, *et al.*, 1956; Shealy and Peele, 1957) has been shown to produce a wide variety of autonomic changes of the type I have just described. It seems reasonable—from the present observations—to suggest that we now have clinical evidence to the same end. And if this be granted, the lateral temporal cortex now joins the orbito-frontal, insular, cingulate and medial temporal cortical sectors (Fig. 10) in providing a projection system

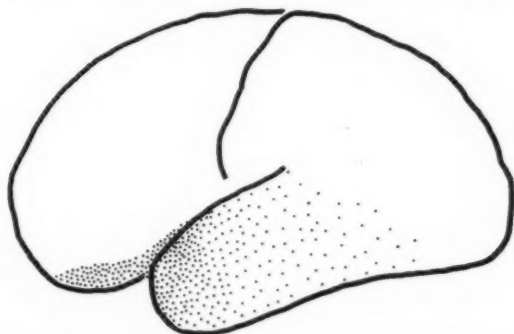


Fig. 10. The topography of the visceral projection system from the lateral temporal cortex, depicted as a posterior extension of the visceral projection system from the orbito-frontal, insular and medial temporal cortical sectors. The density of the dots represents the relative density of the projection system, as suggested by the analysis of symptoms described in the text.

³Ictal incontinence of course occurred in a number of these patients—but as this is not especially associated with seizure discharges arising in the temporal lobe, it is not discussed here.

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to the hypothalamus by way of which various autonomic functions in man may be altered to produce a striking symptomatology ; although this is not yet widely recognised as indicative of dysfunction of the temporal lobes.

Visual field defects

The visual field defects associated with lesions of the temporal lobe have been amply described by others (*e.g.*, Spalding, 1952 ; Hughes, 1954) ; but it is relevant, in the present context, to note the nature of such defects encountered in this series with lesions of each of the three temporal segments defined above.

Visual field defects, of some type or other, were encountered in one quarter of the present group of cases¹. They were most frequent with posteriorly situated lesions, being present in almost two-fifths of this group of cases ; and in all of them the defect consisted of a contralateral homonymous hemianopia—although one case with an abscess in the right posterior temporal segment initially showed a transient left homonymous upper quadrantic defect which rapidly became a hemianopia.

Field defects were next most common with the mid-temporal lesions, being noted in one quarter of them. Here, however, both quadrantic and hemianopic defects were seen—although homonymous hemianopias (four cases) were twice as frequent as persisting quadrantic defects (two cases). In each of the latter two cases the quadrantic defect was contralateral and homonymous, and involved the superior quadrants only.

Amongst the anterior lesions field defects were rare, being noted in but a single case—here the disturbance was a persisting left homonymous superior quadrantic defect, due to an old post-traumatic scar involving the right temporal pole and lateral surface of the right anterior temporal segment.

In those patients of the present series then, in whom it was possible to examine the visual fields, the incidence of defects therein increases in an antero-posterior direction with lesions along the lateral aspect of the temporal lobe. In the same direction, quadrantic defects diminish in relative incidence while hemianopic defects increase, a mixture of the two (as established defects) being associated only with mid-temporal lesions.

Speech disorders

Further details of the complex symptomatology of temporal lobe lesions will not be reviewed here ; but I feel it would be remiss of me to close this report without some reference to the disorders of speech encountered in the present group of cases. These fall into two distinct categories—first, those associated with ictal disturbances and consisting either of vocalisation or speech arrest ; and second, the non-ictal dysphasias. In the present series, the latter were much more frequently encountered than the former ; and the regional associations within the temporal lobe of these two types of disturbance were very different.

¹It was not, of course, possible to test the visual fields pre-operatively in those patients unable to cooperate adequately.

Ictal vocalisation occurred only in two cases, both of them fully right-handed individuals with lesions in the lateral surface of the anterior segment of the right temporal lobe. In each instance the lesion was an irritating glial scar, consequent upon a head injury in one case and a brain abscess in the other. Neither patient had any evidence of dysphasia at any time, even with the initial lesion. The vocalisation, which was the initial event in a complex psychical, somatic and visceral seizure sequence in each case, consisted in the sudden utterance of a single short coherent sentence which was distinguished by its irrelevancy to the situation in which it occurred, and whose content differed on successive occasions. Thus one of these patients said suddenly to me, as a seizure began, "I think we are lost"; on another occasion the same patient said "my hands are getting dirty"; and on yet another occasion "won't we be late." You will note that in each of these cases the irritative lesion was located in what appeared to be the non-dominant hemisphere, in relation to speech functions.

Exactly the reverse was the case in the patients with *ictal speech arrest*. This occurred in three individuals, each with a post-abscess scar in the left hemisphere—in the anterior temporal segment in one case, but in the middle segment in the other two. As all three patients were fully right-handed, and as each of them had had a dysphasia in association with his original abscess, it is clear that in the present series ictal speech arrest arose only in connection with seizure discharges from the dominant hemisphere.

Non-ictal dysphasias were encountered² most often in right-handed patients with mid-temporal lesions in the left hemisphere. Irrespective of laterality, dysphasia was noted in two-fifths of the cases with lesions of the middle temporal segment in comparison with one-third of the anterior temporal cases and but a single case with a posteriorly situated lesion. In all the fifteen dysphasic patients but one, the lesion was situated in the left hemisphere in a fully right-handed individual—the sole exception was a patient with a right mid-temporal abscess who was ambidextrous in relation to the use of his hands, but preferred to use his left leg when kicking a ball. In other words, in almost one half of the patients with lesions of the left temporal lobe a dysphasia was detected on clinical examination; while in two-thirds of the dysphasic patients the lesion was in the middle temporal segment on the left side.

CONCLUSION

I do not propose to elaborate this subject any further here. But I hope that what I have said will illustrate the value of conducting a clinical investigation in the light of the data provided by experimental studies in anatomy and physiology; and that it will indicate to you that results of practical significance for surgical diagnosis and treatment may thereby

²The figures given here probably represent only the minimum incidence of dysphasia in the series; for there is little doubt that more elaborate testing of speech functions would uncover more subtle disturbances than were detected in this study.

SURGICAL CONSIDERATIONS OF THE TEMPORAL LOBES

emerges. For the neurosurgeon at least, anatomy and physiology can never be disparate disciplines, for the success of his day-to-day work hinges on the use he can make of the data from both fields.

ACKNOWLEDGMENTS

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PROCEEDINGS OF THE COUNCIL IN JANUARY

AT A MEETING of the Council on 9th January, with Prof. Sir James Paterson Ross, President, in the Chair, Mr. B. K. Rank, of Melbourne, was appointed Sir Arthur Sims Commonwealth Travelling Professor for 1958 and will visit Canada at the end of this year.

Prof. Sir Harry Platt (Past President) was congratulated on receiving a Baronetcy in the New Year Honours, and Professor Lambert Rogers on receiving the C.B.E.

The deaths of Sir Thomas Dunhill (Honorary Fellow) and Viscount Waverley (Hunterian Trustee) were reported and noted with deep regret.

It was reported that Dr. G. S. W. Organe had been appointed Joseph Clover Lecturer for 1959.

A Diploma of Fellowship was granted to A. B. Cassie, a Diploma of Membership to V. P. Nagpal and a Diploma in Orthodontics to P. F. G. Whitfield.

Dr. C. A. Keele was elected to the Fellowship of the Faculty of Anaesthetists.

Mr. L. E. C. Norbury was re-appointed as the representative of the College on the Council of the Queen's Institute of District Nursing.

Congratulations were sent to seven Fellows on attaining the jubilee of their Fellowship.

The receipt of one Jacksonian Essay for 1957 was reported.

A suggestion made by a boy of thirteen that the College should institute holiday lectures for children was favourably received.

The following diplomas were granted, jointly with the Royal College of Physicians:

Laryngology and Otology (21); Anaesthetics (95); Medical Radio-Diagnosis (50); Psychological Medicine (45); Tropical Medicine and Hygiene (3); Pathology (9); Public Health (9); Child Health (1).

The following hospitals were recognised under paragraph 23 of the Fellowship Regulations:

HOSPITALS	POSTS RECOGNISED		
	General (all 6 mths.)	Casualty (all 6 mths.)	Unspecified (all 6 mths.)
SLOUGH—Upton Hospital (additional)	2 H.S.'s. (pre-registration)		

SIR SIMON MARKS

SIR SIMON MARKS was formally admitted to the Honorary Fellowship on 2nd January at a dinner given in his honour by the President. Members of the Council and members of the Marks Trustees were present with their ladies.

As soon as the company were assembled at table, the Vice-Presidents (Sir Russell Brock and Sir Archibald McIndoe) introduced Sir Simon Marks, and Sir Archibald McIndoe presented him to the President in the following words :

"MR. PRESIDENT, LADIES AND GENTLEMEN,

In the long history of this College there are very few who are not surgeons who have ever received the highest honour which this College can bestow—its Honorary Fellowship. Today, excluding the Royal Family, there are only three persons living who have actually received it. Lord Nuffield, the greatest benefactor of British medicine of all times, Sir Winston Churchill, the greatest living Englishman, and Sir Arthur Sims, Founder of the Sims Fellowships, which have done so much to weld together Commonwealth Medicine.

"Tonight we meet to bestow this honour upon another great benefactor of the College, Sir Simon Marks. It is the custom on such occasions for the senior Vice-President to pay a tribute to the candidate on his presentation to you, Sir, and I should like to thank Sir Russell Brock for so generously allowing me this privilege on this particular occasion. Many of you will know and understand the reasons why.

"Firstly, it is a particular pleasure for me. Secondly, Simon is a very modest man who loathes publicity and it would be almost impossible for anyone else to discover and to expose the range and nature of his interests. I know them because we have been close friends for many years. I cannot tell you all that I know about him but, in the short time at my disposal, I can tell you something of the man himself.

"Three characteristics have dominated his life. The first is his life-long interest in scientific and technological achievement and his insistence that through research and its practical application a way will be found to solve the problems of mankind whatever they may be. He is among the leaders who have brought the technician from the backroom to the frontroom. He has always fought against bureaucracy and remote control. He has always laid great stress on the importance of good human relationships. Thus he built up his great firm not as a simple distributing agency for other people's goods but as a highly scientific organisation which is a model for all such industries in the world today. Cutting sharply across the bounds of inter-trade jealousies and competitive practices his firm now advises upon the selection and quality of the raw materials used by the manufacturers who supply him. He has improved upon their methods of manufacture and has set standards of quality which have made his business the envy of the world. To do this he set up a consulting and advisory panel of experts whose services are given freely to those who require them. In this, his own field, he has produced a social revolution entirely due to his scientific outlook. For this in 1939 the University of London awarded him the Doctorate of Science in Economics. Today there is scarcely a British industry which does not salute Simon Marks as one of its great captains. This is his work and his business. His other interests have always looked outwards and perhaps it was that same scientific approach which led him to back a certain young lecturer in biochemistry in the University of Manchester; a man distinguished in science who was later to become the first President of the Israeli

SIR SIMON MARKS

Republic. And I have myself heard from Dr. Chaim Weizmann how much he owed to Simon Marks in founding the Israeli State.

"In this, as in many of his other interests, Simon has been partnered by his brother-in-law, Israel Sieff. It is said by those who should know that at Weizmann's death either could have been President of Israel, though I suspect that it could only have been a joint Presidency, so closely are these brothers-in-law allied in temperament and in action. For fifty years they have acted together as a 'David and Jonathan' partnership. It was certainly the same scientific interest which led Simon to help found the Air Cadets for the Royal Air Force in 1938 and to ensure that young men who wanted to serve England in that Service should come to it with informed minds. With the same devotion during the war he assisted to pioneer fog dispersal on airfields as a member of the Petroleum Board. Later he became a Director of the newly formed British Overseas Airways Corporation and did much to establish this important body. For these and many other activities he was knighted in 1944. Twelve years ago he founded the Marks Fellowships in Plastic Surgery and as a result there are to-day fully trained plastic surgeons in various parts of England, in Northern Ireland, Canada, Australia, Kenya, Southern Rhodesia and even in the United States of America. His influence on this surgical speciality has been profound. He has contributed to the Universities of London and Manchester; to Hospitals such as St. Mary's, Westminster, and many others, and more recently to our Sister Royal College of Obstetricians and Gynaecologists. These are only a few of his public interests but they serve to show that behind it all Simon has been activated by his passionate interest in scientific achievement.

"His second outstanding characteristic is his capacity for identifying himself completely with the object of his interest. His powers of concentration are remarkable. I can testify to this and his colleagues tell me that I should now know what it is like to be a Director of Marks & Spencer. In the College he realises completely its vast possibilities for the training of surgeons and hence for the conquest of disease. Already he has made himself an integral part of this College. He does not say 'here is a sum of money to help you in your fight—let me know when you have used it.' He says 'I am now one of you; let us mobilise *our* resources, let us go forward to win *our* battle.' It is this extraordinary facility for inspired leadership which has without doubt fired the imagination of this Council to persist with its ambitious plans.

"The third great characteristic of Simon Marks and his most endearing one is his genius for friendship. Of this there is abundant evidence both in the world of finance and business where his word is universally known as his bond. It is now extended to medicine. But tonight the evidence is all around him, for he is surrounded by his family, all his sisters and their husbands, his brother-in-law, his nephews and neices, his son-in-law, also a doctor, and especially his wife, Lady Marks, who has been his warm supporter and counsellor all his life. I know the closeness of the bonds which hold this great family together and I know what intense pleasure it will give them to see the head of the family thus honoured. To all of them this College is deeply indebted, for they have all contributed heavily to the tremendous sum now approaching £300,000, which has enabled us to refloat our ship.

"Finally, Sir, I would like to quote a sentence which will be well known to Sir Simon for he sees it every day of his life. It is on his writing table but it will give those of you who have not seen it some idea of the measure and quality of the man we honour tonight.

'The day is short and the work is great and the labourers are sluggish and the reward is much and the master of the house is urgent. It is not thy duty to complete the work but neither art thou free to desist from it.'

SIR SIMON MARKS



Sir Simon Marks receiving the Diploma of Honorary Fellowship from the President.

"Mr. President, I present to you Sir Simon Marks to receive at your hands the Honorary Fellowship of the Royal College of Surgeons of England."

The President (Sir James Paterson Ross) then formally admitted Sir Simon Marks to the Honorary Fellowship and presented his diploma to him. Sir Simon at this point briefly replied :

"Mr. President : I am grateful to you for admitting me to the Honorary Fellowship of the Royal College of Surgeons. I am deeply moved by the great and rare honour you pay me. I hope to be worthy of this mark of your esteem."

At the end of the dinner, and after the loyal toast, the President proposed the health of Sir Simon Marks, referring first to the great happiness of the present occasion and continuing :

"For me it has been happiness as well as a privilege to admit you to the Honorary Fellowship.

"And now it gives me still further happiness to propose your health.

"We have many reasons for feeling joyful—the opportunity of entertaining Lady Marks and you, when heretofore you have so generously entertained us ; to have with us several members of your family—and the Council itself consists of so many folk of goodwill that the whole is a family party and perhaps some informality will not only be permitted but considered fitting to the occasion.

"Therefore this is not so much a speech as an informal expression of our high regard and affection for you.

SIR SIMON MARKS

"To make you an Honorary Fellow of the College is not only to give you the highest honour it is in our power to bestow ; it is to confirm you in a position which you had already won for yourself by your active and informed interest in our affairs which has expressed itself not only in the form of magnificent material and much needed help in our problem of making ends meet, but also in a desire to understand our ambitions and objectives and an active encouragement in the pursuit of our ideals which we have never experienced before, though we owe much to many generous benefactors. You have already identified yourself with the College, and for a long time you have been better to us than a brother.

'One man in a thousand, Solomon says,
Will stick more close than a brother.
Nine hundred and ninety-nine of 'em go
By your looks, or your acts, or your glory.
But if he finds you and you find him,
The rest of the world don't matter ;
For the Thousandth Man will sink or swim
With you in any water.'

"The only trouble about poetry is that although it sounds nice it doesn't always say exactly what you want it to—no doubt that's a fault of selection—but in this instance I think instead of one man in a thousand, we'd be nearer the mark if we said 'one man in a million'—and when you are around the idea of sinking never seems to enter our heads—your own buoyant spirit keeps us all swimming happily along.

"Furthermore it isn't quite true to say 'the rest of the world don't matter,' for one of the things you are teaching us is how to tackle the rest of the world to make them see how much the College matters.

"One way of interesting people in the College is through the bonds of friendship—an appeal to men's hearts—and surely there can be no better way of really binding men together in a common cause. But business men are usually said to be hard-headed (if they are soft hearted as well, so much the better) and we must be prepared, as we are, to talk to them in a hard-headed way—for the College is not only an institution which one can love because of its history and its tradition and its surgical benevolence, but it is a National asset, doing a job for the country and for the Commonwealth which no other body can do in just the same way, and for these very hard-headed reasons it should command the good will and the help of the most influential bodies in the land.

"You should know that now you are a Fellow of this College you have certain privileges—you may make use of the Hunterian and other Museums and the Library, attend all Lectures delivered at the College, and be admitted as Visitor to the several examinations of the College. By ancient right your horses may not be taken from your carriage to pull a fire engine. The chief thing we would like you to know is that if this is possible you will be more welcome than ever to come here as often as you can.

"Furthermore we hope that we may see in you what we have observed in some other friends and colleagues who have embarked upon a fresh career in the prime of life—they have been reinvigorated and rejuvenated as though they were starting life anew. Your associates may not relish the idea of your being even more energetic than you are at present, in their own interest, but we hope that you may enjoy the privileges of your Fellowship for many a long day.

"We had an idea that we would like to give you something as a memento of this occasion but couldn't hit upon the right idea—till we appealed to woman's wit and the problem was solved. Clearly a surgeon needs above everything else

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a knife, but knowing your enthusiasm and fearing (perhaps quite unjustifiably) for your patients, it seemed best that it should not be a sharp one. So we've got you this paper knife to be on your desk as a constant reminder of the fact that you are a Fellow of this College. We realise that your ordinary letters will be operated on by an assistant; but the *private* ones will be done by yourself and so we hope that our present to you may be useful as well as decorative. It was made a few years before this College was founded, but I hope you will forgive the anachronism of our having had the College crest engraved on its hilt.

"Ladies and gentlemen, let us rise and drink to the health of Sir Simon Marks."

Sir Simon Marks in reply thanked the President for his human speech and again expressed his great appreciation of the award of the Honorary Fellowship and the invitation to "become one of you." He then said:

"When, as a member of the Court of Patrons, I was invited by the President to take an active part in refloating your ship, for the moment aground, I could conceive of no greater privilege than to accede to his request.

"Thanks to Sir Archibald McIndoe I was no stranger to the work of the College. I had spent many interesting hours listening to him expounding on the golden age of medicine: on the dramatic advances in surgery: on the penetration into the innermost recesses of the human body, the heart and the brain: on the miracle of anaesthesia: the impact of antibiotics in surgery: blood plasma, transfusions—so many things unknown but a short generation ago.

"Then he would describe the importance of scientific research on the problems affecting surgery, bringing new knowledge and with it the approach to new techniques.

"I was fascinated by his unfolding of the story of the partnership of minds of the surgeon and the scientist in the struggle against disease which afflicts mankind. I had, to some extent, been indoctrinated by a master of his art.

"I wondered how many persons knew or had an inkling of the functions of the College—its aims and purpose. Even those men who had benefited from the skill of the surgeon, and who owed their lives to him.

"How does the work of the College affect us all individually? Was it a centre of abstract learning? How and who supported the College financially? Their work seemed to be shrouded in anonymity. The story of the work of the College is the best kept secret.

"It must have been clear that as you expanded your scientific research and teaching facilities the funds at your disposal could not keep pace with the demands: and so it was inevitable for the ship to run aground, even if for a brief moment.

"I marvel at the work already accomplished by the limited funds at your disposal. It is, however, essential that the area of public interest should be widened and that the story of your work should be told to a greater audience. That is the task before us.

"To the partnership of the surgeon and the scientist we must seek to find a third partner—a body of enlightened citizens who can support you and finance the intensification of your research. For that must be the springboard for further advances in the art and science of surgery. We must telescope time.

"Our research scientists have written a series of papers outlining their activities. All these papers bear witness to the scope of progress which has already been made in surgery, but more important still they point the way to the future with its limitless possibilities when funds are available.

"We laymen must be grateful to you for your dedicated work, which brings hope, comfort, peace of mind, healing, to many sorely tried men and women."

In Memoriam

SIR THOMAS DUNHILL,
G.C.V.O., C.M.G., M.D., F.R.C.S., F.R.A.C.S.
(1876-1957)

WHEN SIR THOMAS DUNHILL died at his Hampstead home on Sunday 22nd December 1957 a few days after his 81st birthday, a great figure passed from the world of surgery. Though he had been living in retirement for some years and in failing health for several months, he continued to read his journals and to take a lively interest in the affairs of the Royal College of Surgeons of England and the sister College of Australasia. His own malady was an unusual and somewhat obscure complaint, and his curiosity was not satisfied until he had obtained and read the most recent papers on the subject.

In order to form a true estimate of Dunhill's contributions to surgery it is necessary to examine the records of hospitals and medical societies in the first decade of this century, when the acknowledged masters of thyroid surgery—Berry, Horsley and Trotter in this country, Kocher on the Continent, and Halsted in the United States—were recording a small number of successful operations for Graves's disease. It was the high mortality rate which stimulated Dunhill's interest when he was still a House Surgeon at the Royal Melbourne Hospital, and when two years later he was appointed to the Staff of St. Vincent's Hospital at the age of thirty he was given, though grudgingly at first, the opportunity of translating his ideas into practice. Experiments on goats helped his technique; he eliminated the dangers of general anaesthetics as they were then administered by using local anaesthesia; and by 1908, two years after his appointment to St. Vincent's, he had sufficient material for a paper on the treatment of exophthalmic goitre by partial thyroidectomy under local anaesthesia. No publication could do justice to the struggles he had had to get these very ill patients through—but he used to tell with a twinkle in his eye about meeting Lady Berry at dinner years later in London, and of her comment on his results—"No doubt Graves's disease in Australia is a much milder form than we have here".

The accepted operation for toxic goitre in those days was hemithyroidectomy, and Dunhill noticed as he followed up his patients that after an initial improvement they relapsed, and therefore in 1908, after much anxious thought, he decided to remove the greater part of the other lobe. This also was published before he visited the United States in 1911, but one at least of the leading American surgeons had not heard of this advance till Dunhill told him of it and sent him a reprint of his paper. Dunhill was always punctilious about acknowledging the source of any information he quoted; and although he was not given to advancing his own claims, yet he could never forget that his priority in the bilateral operation for toxic goitre was not acknowledged in American literature.

SIR THOMAS DUNHILL

At the start of the 1914 War he went to France with the Australian Imperial Forces, and it was when he was in London on leave in 1915 that Sir Hector MacKenzie asked him to operate on a very ill girl who after many operations for tuberculosis had developed a toxic goitre. This was his first patient in England, and she is alive and well to-day.

Though he must have had a strong constitution, he also had more than his share of illness, and quite early in life he suffered from nephritis. It was because of persistent evidence of renal damage that he was not allowed to serve with the forward units in France, yet so highly were his services esteemed that in 1918 he was appointed a Consultant Surgeon to the B.E.F. and in 1919 the award of the C.M.G. set the seal upon his record of war service.



Sir Thomas Dunhill

When the war was over he returned to Melbourne, but in 1920 abandoned the prospect of a brilliant surgical career in Australia and accepted the invitation to join the Staff of St. Bartholomew's Hospital as Assistant Director of the recently formed Surgical Professorial Unit under the direction of Professor George Gask. The Hospital should always be grate-

SIR THOMAS DUNHILL

ful to him for this self-sacrificing decision; no doubt as the years went by he profited by the move because his reputation in London was bound to be greater than it could have been in Melbourne—but the profit to Bart's was greater still. His work benefited the patients, the students and the Staff of the Hospital, and attracted visiting surgeons in large numbers from near and far. Links were thus forged with individual surgeons and with surgical clinics throughout the English-speaking world which have been of the greatest value in the training of the younger surgeons associated with St. Bartholomew's.

He rapidly established a large private practice which came from many sources, partly through medical colleagues at Bart's but also through Australian friends and from several of the well-known consultant physicians in London, some of whom he had known before he came to practise here. He operated on many of Lord Dawson's patients and it was through the association with him that Dunhill was appointed to the Royal Household, where his services were rewarded with the highest honours which the Sovereign can bestow upon a surgeon.

He valued very highly his associations with the Royal College of Surgeons. He twice gave Arris and Gale Lectures, in 1931 on Carcinoma of the Thyroid Gland, and in 1934 on Diaphragmatic Hernia. He was made an Honorary Fellow of the College in 1939. He had already been awarded the Honorary Fellowship of the Royal Australasian College of Surgeons and an Honorary Doctorate from the University of Adelaide. Honorary Fellowship of the English College had never before been granted to a surgeon in active practice in London, and he was deeply appreciative of this signal tribute from his surgical colleagues. In 1950 he was awarded the Cecil Joll Prize and in 1951 he delivered the Cecil Joll Memorial Lecture, taking as his subject the evolution of the surgical treatment of thyrotoxicosis during his lifetime.

In the Second World War Sir Thomas served as Consulting Surgeon to the Australian Imperial Forces with the rank of Brigadier, and he also worked in the E.M.S. at Harefield in the St. Mary's Hospital sector.

His pre-eminence in thyroid surgery has tended to obscure his wider interest in general surgery, for he was in the true sense of the term a general surgeon. His strong, deft, and gentle fingers enabled him to do many things which to others would have been impossible, and his clinical judgment, based on keen observation and a well-stored and well-ordered memory, often seemed to his bewildered assistants to have an element of magic about it. It was unfortunate that he did sometimes find it difficult to explain to his juniors exactly why he came to certain conclusions—he preferred to teach by example rather than by precept. It is hard to accept the fact that his restless, enquiring, critical mind is now for ever stilled—yet the influence of his work and his personality live on in the practice and in the teaching of those who were privileged to be brought up under his strict discipline and wise guidance.

J.P.R.

VISCOUNT WAVERLEY,
O.M., P.C., G.C.B., G.C.S.I. G.C.I.E., F.R.S. K.St.J.

GREAT HONOUR AND due honour has been done to Viscount Waverley for his life of distinction as a statesman and public servant, and many tributes have been written bearing evidence of the immense gratitude which the country feels for his memory.

In these pages it is Viscount Waverley, the friend of the College, who must be remembered with admiration, esteem and thankfulness. His closest connection with the College was as a Trustee of the Hunterian Collection, in which he took a keen interest, and he had been a member of the Board of Trustees for ten years. His scientific mind was naturally attracted by the works of John Hunter, but it was in the meetings of the Trustees, which he attended with great regularity, that his abilities were most valuable. The crux of any problem was immediately pin-pointed by that incisive intellect and his advice would be given with unfailing sagacity and clarity.



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Lord Waverley

Lord Waverley was Chairman of the British Postgraduate Medical Federation at the time when the Institute of Basic Medical Sciences was founded, and his authoritative presence in that post gave encouragement and reassurance to the College in this new venture.

In matters of a more general nature also, he showed that he had the

VISCOUNT WAVERLEY

interests of the College at heart and seemed glad to be approached for his help when it was needed. The College mourns for a great man, and joins the nation in sympathy with his widow and family.

K.C.

SURGEON-COMMANDER JOHN JOYCE KEEVIL,
D.S.O., M.A., M.D.Camb., D.T.M.&H., F.S.A., F.R.HIST.S., J.P.

JOHN KEEVIL HAD distinguished himself as a naval surgeon on active service and as a medical historian, before his untimely death at the age of fifty-six on 16th December 1957. Born in 1901 he was educated at Marlborough, at Caius, and at St. Thomas's. He qualified in 1925 and began his career in the Malayan Medical Service, but soon transferred to the Royal Navy where he had risen to the rank of Surgeon-Commander before war broke out in 1939. During the years of peace he had served in many parts of the world, but kept up his scholarship and wrote several articles on aspects of naval history and biography.

He was awarded the D.S.O. for courageous action, when the aircraft carrier H.M.S. *Illustrious*, in which he was senior medical officer, was severely dive-bombed in the Mediterranean in January 1941. Keevil and his two subordinates rescued and tended the countless wounded amid battle, flame and death, performing emergency operations in an ill-lit and flooded theatre. His critical report and recommendations helped the Medical Department of the Admiralty to improve the medical conditions in the ships of the Royal Navy.

He was for a period naval editor of the *Official Medical History of the War*, but went again on active service afloat. At the end of the war he was appointed Keeper of the Library under the Harveian Librarian at the Royal College of Physicians. Here he was faced with the laborious task of handling the thousands of books which had been in store for five years. He carried through this reorganisation almost single-handed, and left the library with improved arrangement and a trained staff. He also found time for research in the College archives and published well-written biographies of the two Baldwin Hameys, father and son, physicians in London in the sixteenth and seventeenth centuries. These books throw valuable light on the conditions of practice at that time.

Keevil now turned to his greatest work, a history of *Medicine and the Navy*. With the support of the Wellcome Trust he published one volume covering the years from 1200 to 1649 and had completed the second volume, carrying the story to the end of Marlborough's wars. It is a tragedy that the one man equipped for this work should have died with his task unfinished. Keevil combined the experience of a serving medical officer with a critical sense, a pleasant style and accurate scholarship. He is survived by his widow, herself a distinguished writer under her maiden name of Averil Mackenzie-Grieve.

W.R.L.F.

HONOURS CONFERRED ON FELLOWS AND MEMBERS

IN THE NEW Year Honours List H.M. The Queen graciously conferred the following honours on Fellows and Members of the College :

Baronet	Sir Harry Platt, F.R.C.S., Past President.
G.C.V.O.	Sir Stewart Duke-Elder, K.C.V.O., F.R.C.S.
Companion of Honour	Viscount Nuffield, G.B.E., Hon. F.R.C.S.
Knight Bachelor	W. G. D. Upjohn, O.B.E., F.R.C.S.
	W. Bentley Purchase, C.B.E., M.C., M.R.C.S.
C.B.	Air Vice-Marshal F. E. Lipscomb, C.B.E., M.R.C.S.
C.M.G.	D. D. McKenzie, F.R.C.S.
K.B.E.	Surg. Vice-Admiral R. C. May, C.B.E., M.C., F.R.C.S.
C.B.E.	Prof. Lambert C. Rogers, F.R.C.S., Member of Council.
	S. Cochrane Shanks, F.F.R.
	T. P. Eddy, M.R.C.S.
	E. A. Trim, O.B.E., M.R.C.S.
O.B.E.	Surgeon Lt. Com. D. G. Dalgleish, M.R.C.S.
	Squadron-Leader J. Ernsting, M.R.C.S.
	J. S. Thomas, J.P., M.R.C.S.
M.B.E.	A. J. P. Coetzee, M.R.C.S.
	J. S. Robinson, M.R.C.S.

COLLEGE PUBLICATIONS

READERS ARE REMINDED that the following publications issued or sponsored by the College may be obtained from the Editorial Secretary, Royal College of Surgeons of England, Lincoln's Inn Fields, London, W.C.2.

Lives of the Fellows, 1930-1951. By the late Sir D'Arcy Power, K.B.E., F.R.C.S., Honorary Librarian, and continued by W. R. Le Fanu, M.A., Librarian. A single volume, bound in blue cloth, of 889 pages, containing the Lives of all Fellows known to have died between 1930 and 1951. £2 2s. 0d. post free.

A Record of the Years from 1901 to 1950. Edited by Sir Ernest Finch, M.D., M.S., F.R.C.S. A slim volume, illustrated, containing a brief history of the College between the centenary and the 150th anniversary of the foundation with lives of all the Presidents since 1900, written by special contributors from their personal knowledge. In red cloth 9s. post free or red paper covers 5s. 6d. post free.

John Hunter, a List of his Books. A short-title bibliography of all known editions of John Hunter's books, compiled by the Librarian. Printed at the Cambridge University Press, and bound in green cloth. 2s. 6d. post free.

**William Clift.* By Jessie Dobson, B.A., M.Sc., Anatomy Curator. A new biography, fully illustrated, of the first Conservator of the Museum at the College. Published by William Heinemann Medical Books Ltd. Bound in blue cloth; 144 pages with frontispiece portrait and 31 plates. 8s. 6d. post free.

*A separate cheque for this publication would be appreciated.

LIFE OF SIR GEORGE BUCKSTON BROWNE, F.R.C.S.

A BIOGRAPHY HAS been written of Sir George Buckston Browne, one of the greatest benefactors the College has had, by Miss Jessie Dobson, B.A., M.Sc., and Sir Cecil Wakeley, Bt., K.B.E., C.B., LL.D., F.R.C.S. The publishers are Messrs. E. & S. Livingstone and the price of the book is 25s. net.

APPOINTMENT OF MEMBERS AND FELLOWS TO CONSULTANT POSTS

T. E. C. WILLIAMSZ, F.R.C.S.	Consultant E.N.T. Surgeon, General Hospital, Jaffna, Ceylon.
R. PARARAJASEGARAM, F.R.C.S.	Consultant Surgeon, Victoria Memorial Eye Hospital, Colombo 7, Ceylon.

The Editor is always glad to receive details of new appointments obtained by Fellows and Members, either through the Hospital Boards or direct.

DIARY FOR FEBRUARY

Mon. 17	Course in Clinical Surgery begins.
Wed. 19	D. Phys. Med. Examination (Part II) and D.T.M. & H. Examination begin.
Thurs. 20 3.45	DR. F. STANSFIELD—Arnott Demonstration.*
Wed. 26	Primary F.D.S. Examination and D.Orth. Examination begin.

DIARY FOR MARCH

Tues. 4 5.00	DR. R. A. GOODBODY—Erasmus Wilson Demonstration.*
Thurs. 6 5.00	PROF. D. A. MACFARLANE—Hunterian Lecture—"Cancer of the adrenal cortex."*
5.30	MR. H. JACKSON BURROWS—Otolaryngology Lecture—"Disorders of the cervical spine."*
	First Membership Examination begins.
Tues. 11 5.00	PROF. A. K. BASU—Hunterian Lecture—"Chronic Bengal splenomegaly associated states of portal hypertension."*
Wed. 12 7.30	Monthly Dinner.
	First L.D.S. Examination begins.
Thurs. 13 2.00	Ordinary Council.
5.00	PROF. B. B. HICKEY—Hunterian Lecture—"Malignant epithelial tumours in the Sudanese."*
Tues. 18 5.00	DR. G. T. ALLEN—Erasmus Wilson Demonstration.*
Wed. 19	Board of Faculty of Anaesthetists.
	Annual General Meeting of Faculty of Anaesthetists.
	PROF. W. D. M. PATON—Joseph Clover Lecture—"Mechanisms of transmissions in the central nervous system."*
	D.H.C. Examinations begin.
Thurs. 20 3.45	MR. P. A. RING—Arnott Demonstration.
5.00	PROF. R. A. STEPHEN—Hunterian Lecture—"Malignant testicular tumours."*
Fri. 21 5.00	Board of Faculty of Dental Surgery.
	Last day for applications for Annual Examinerships.
Mon. 24 5.00	PROF. A. SORSBY—Ophthalmology Lecture—"Treatment of ocular palsies."*
Tues. 25 5.00	PROF. J. P. HOPEWELL—Hunterian Lecture—"The hazards of uretero-intestinal anastomosis."*
Thurs. 27 5.00	PROF. R. B. WELBOURN—Hunterian Lecture—"The surgical aspects of adrenocortical disorder."*
Fri. 28	Date of Council Election announced.
Mon. 31	Final Membership Examination begins.

* Not part of the course.

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THE EVOLUTION OF SAFETY IN PROSTATECTOMY

Hunterian Lecture delivered at the Royal College of Surgeons of England

on

9th May 1957

by

A. C. McEachern, M.S.(Adel.), F.R.C.S.(Eng.), F.R.C.S.(Edin.), F.R.A.C.S.
Honorary Surgeon, Royal Adelaide Hospital

THE THESIS WHICH I will try to develop is that the operation of prostatectomy has a relatively short and eventful history in which the early promise of safety was not fulfilled; and that in the middle years of the first half of the century the mortality and morbidity were of a very high order. Some twenty years ago there came a sudden change for the better, which change has been maintained and improved in greater or lesser degree to the present time. It is my purpose to discuss among other things some of the factors which have been responsible for that change.

The place of statistics

In general, it may be accepted that the mortality of an operation will be lower in personal series of cases, higher in collected series, and possibly reflected to the highest level in vital statistics. In Australia as one example the mean deaths from diseases of the prostate excluding carcinoma and expressed as the number per 10,000 of sixty to seventy-nine year old males were as follows:

1921	..	..	..	14.5
1933	..	..	..	15.3
1947	..	..	..	15.3
1954	..	..	..	14.3

These figures certainly do nothing to establish the thesis of increasing safety for which we must turn to data of a different kind.

THE EVOLUTION OF A SAFE OPERATION

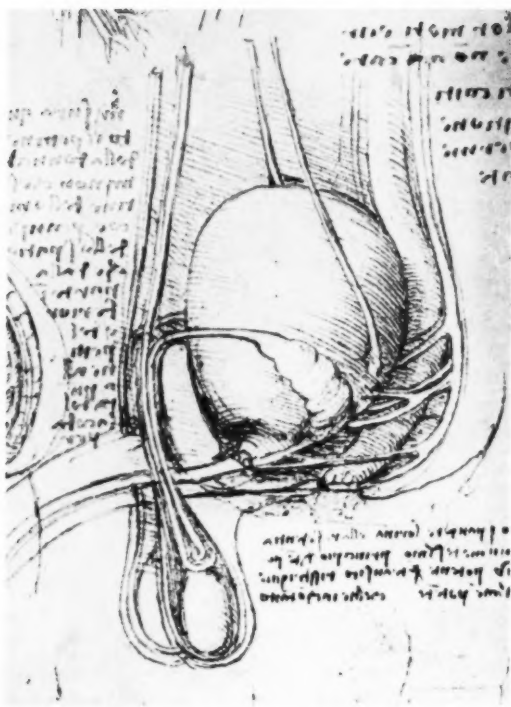
Early history

The early history of the subject in relation to the evolution of safe treatment was concerned first of all with the recognition of the prostate gland in anatomy, and secondly with the recognition of gross surgical pathology of an obstructive kind, and thirdly with the realisation that the problem constituted a challenge to surgical attack.

The idea of operative treatment having been accepted the next stage was the evolution of safe access.

Then came our understanding of the gross intraprostatic pathology which permitted enucleation of the obstructing tissue.

In Leonardo da Vinci's fifteenth-century drawings of the organs of the male pelvis the vas deferens and seminal vesicles are shown, but the prostate is absent (Fig. 1). Vesalius, however, recognised the prostate gland, and it is illustrated in "De Humani Corporis Fabrica" (sixteenth century) (Fig. 2).



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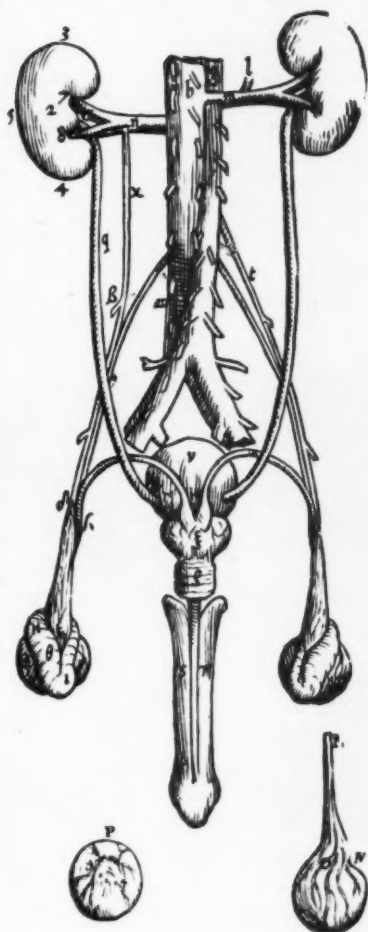
Fig. 1. Drawing of the bladder and male generative organs from *Leonardo da Vinci on the human body*, by C. D. O'Malley and J. B. Saunders.

John Hunter (1788) described in considerable and accurate detail the swelling of the prostate gland which occurred in the decline of life (Fig. 3). He described the changes in the prostatic urethra consequent on prostate enlargement, and the resultant urinary obstruction and bladder hypertrophy. He distinguished clearly between obstruction due to lateral lobe enlargement and that due to the valvular effect of middle lobe enlargement (Fig. 4).

The suprapubic route of access to the bladder was conceived by John Douglas in 1720, and a little later by Cheselden; but it did not become safe and convenient until the introduction of general anaesthesia. The perineal route, on the other hand, was in some respects a product of the pre-anaesthetic era.

Portions of the prostate gland were removed by Amussat in 1827 accidentally, and by Dittel in 1885 deliberately.

THE EVOLUTION OF SAFETY IN PROSTATECTOMY



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Fig. 2. Drawing of the male generative organs from *De Humani Corporis Fabrica* by Vesalius.

In 1889 McGill of Leeds reported three successful cases of removal of the obstructing intravesical middle lobe, and in later cases he removed all or portions of the lateral lobes. In 1890 Belfield of Chicago, and in 1895 Eugene Fuller of New York, advocated and practised enucleation of all obstructing tissue.

Progress had been temporarily halted by the introduction of vasectomy, castration, prostatotomy, and the electrocautery, any success of castration being no doubt linked with the incidence of carcinoma as a cause of prostatic obstruction. Progress was retarded also by the belief that bladder atony would defeat any attempt at removal of the obstruction. At a meeting of the Clinical Society of London in 1887 this view was expressed by Sir Henry Thompson; and at the same meeting a paper was read by McGill reporting successful operations.

The Freyer operation

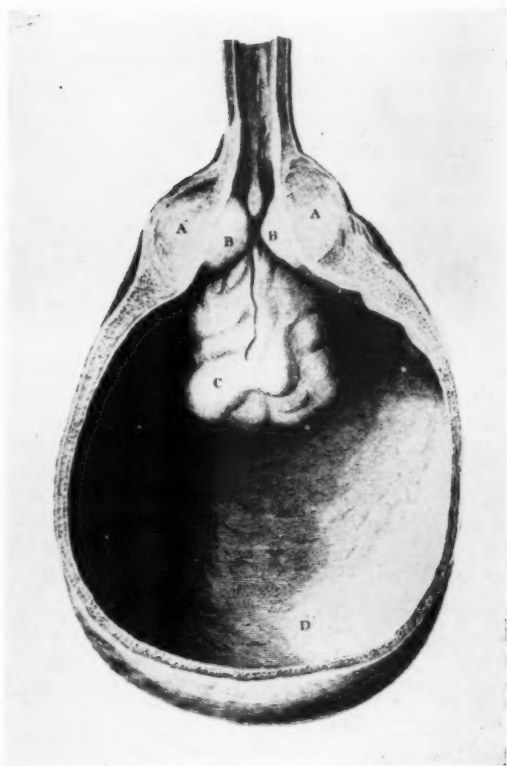
Next came Peter Johnston Freyer who in 1901 wrote "I have in four cases undertaken a new and at first sight very formidable operation for



(John Hunter, 1786)

Fig. 3. Enlarged prostate and hypertrophied bladder.

THE EVOLUTION OF SAFETY IN PROSTATECTOMY



(John Hunter, 1786)

Fig. 4. Enlargement of the middle lobe of the prostate.

radical cure of the enlarged organ namely total extirpation of the prostate." The first patient was operated upon on 1st December 1900, and by May 1932 Freyer had performed the operation 1,674 times with a mortality of 5.3 per cent. This operation with minor variations, but sometimes with a higher mortality, is practised to the present day. The Freyer method of enucleation commencing within the bladder probably results in rupture of the urethra at or only slightly above the triangular ligament, the prostate being removed with the anterior commissure intact.

The Thomson-Walker operation

In 1916 Thomson-Walker, and in 1917 Judd, advocated transvesical prostatectomy by open operation as had been practised initially by Rutherford Morison in 1907. The operation, however, did not find

general favour because it took longer to perform, haemostasis was uncertain unless the cavity were packed, and in general it was not well tolerated by bad-risk patients. Catheter drainage was employed post-operatively.

Perineal prostatectomy

From 1894 perineal prostatectomy was developed and came to be identified particularly with the name of Hugh Young of Baltimore, who made his first important communication in 1903. In spite of certain advantages the operation is not easy, and is associated with a number of serious complications especially in less expert hands. Young, however, was able to report a mortality of 3.5 per cent. and in a large series reported recently by Davis and Lee (1955) the mortality was 2.9 per cent.

Harris prostatectomy

In 1934 Harris published a full description of his suprapubic operation, and a mortality of 2.7 per cent. This figure was sufficient to command notice, and there can be no doubt that the Harris operation was the most important milestone in the evolution of safety in prostatectomy after Freyer. To fully appreciate the significance of his results it is necessary to use as a background the mortality in other important series (Table I).

TABLE I
THE MORTALITY OF SUPRAPUBIC PROSTATECTOMY

1901-32	Freyer	..	..	..	5.3 per cent.
1930	Thomson-Walker	..	..	..	6.08 per cent.
	3,451 General hospital cases	..	..	..	19.5 per cent.
	2,691 St. Peter's Hospital for Stone	..	..	..	9.9 per cent.
1938	Smith, Julian.				
	Royal Melbourne Hospital				
	(collected figures)	..	..	..	18.6 per cent.
1934	Harris	..	..	..	2.7 per cent.
1945	Wilson Hey	..	..	..	6.0 per cent.
	Blood urea less than 80mg. per cent	..	..	..	3.4 per cent.
1948	Millin (a) personal	..	..	..	4.5 per cent.
	(b) sixteen other surgeons	..	..	..	5.3 per cent.
1949	Riches (a) Harris	..	..	..	6.6 per cent.
	(b) Retropubic	..	..	..	6.7 per cent.
1953	Galbraith (Harris)	..	..	..	3.7 per cent.

The details of his operative technique were carefully and clearly set out, there were precise directions governing pre-operative and post-operative management, and there was explicit advice regarding the care of the indwelling catheter. In the Harris technique there were four fundamental principles:

1. Strict asepsis and antisepsis in the management of the indwelling catheter before and after operation.
2. Intra-urethral enucleation.
3. Haemostasis.
4. Plastic obliteration of the greater part of the prostatic cavity.

Haemostasis was achieved by the insertion with a boomerang needle of three groups of sutures:

THE EVOLUTION OF SAFETY IN PROSTATECTOMY

1. Posterolateral sutures in the prostatic rim.
2. A retrigonisation suture designed to carry the torn apex of the trigone deeply down into the prostatic cavity to reconstruct the floor of the prostatic urethra.
3. Anterior transverse oblitative sutures to reduce the prostatic cavity.

The bladder was drained by an indwelling urethral catheter suspended by a suture to the anterior abdominal wall, and by a suprapubic tube, or not, according to the degree of haemostasis.

The importance of Harris's contribution is shown by his results, which were accomplished in a surgical world clouded by a level of mortality and morbidity in prostatectomy which in many centres was simply unpublishable ; and this was at a time when surgery as a whole had reached a high technical level. It is suggested that the success of the operation lay in precise attention to detail, in haemostasis, and in the method of enucleation. In the light of present-day knowledge the attempt to reline the prostatic cavity was probably unnecessary. A good deal of evidence exists to show that the epithelium of the prostatic urethra regenerates from the acini of the remaining prostatic tissue and in the process undergoes metaplasia to the transitional type. Berry and Miller (1945) found that the new epithelium began to appear in six days, and healing (in their cases, after resection) was complete in one month.

The way the prostate is enucleated is, of course, the essence of the operation of prostatectomy, and there can be no doubt that what happens in the hidden depths determines in the highest degree the safety or otherwise of the operation.

It is customary to distinguish between the Freyer type of enucleation and the intra-urethral method, and the arguments raised in this lecture centre around this distinction. To some extent, however, the distinction is artificial and perhaps more important in teaching than in actual practice. The experienced surgeon will by instinct execute an accurate and gentle enucleation by whatever method he uses, but his assistants might not find the way so easy unless very clear and expert instruction is given.

The inestimable virtue of the Harris method of intra-urethral enucleation is that it is capable of precise description, illustration, and demonstration ; and, by preserving the verumontanum, it ensures the safety of the external sphincter and the urethral mucosa beyond. This, I believe, was Harris's main contribution. He was by no means the first to employ intra-urethral enucleation, which was derived from Bentley Squier (1911), but in the clarity of his teaching he was undoubtedly the most effective exponent of it. Nor, indeed, was Freyer the first suprapubic prostatectomist, nor Young the first perineal, nor Millin the inventor of the retropubic approach ; but credit is due to those whose teaching gains acceptance.

Other methods of enucleation

Having in mind the importance of this part of the operation it is instructive to read the exact descriptions given by different authors, and because of its historic relation to the present discussion that of Bendley Squier is of special interest. The bladder having been filled, the anaesthetic was commenced, and at the moment of relaxation the abdominal incision was made and the bladder exposed :

"The procedure is to insert the finger into the internal meatus and break through the roof of the prostatic urethra . . . the enucleation is begun by pushing the finger upward and forward freeing the apex of the lobe from its attachment to the urethra and triangular ligament. It is then swept round the surface, and the lobe is hooked back into the bladder with the apex pointing upwards, then a little separation from the bladder mucosa completes its removal. A similar procedure is repeated on the other side and the enucleation is complete . . . The moment the prostate has been delivered the anaesthetic is stopped . . . carried out in this way a suprapubic prostatectomy can be accomplished in four to five minutes in most cases."

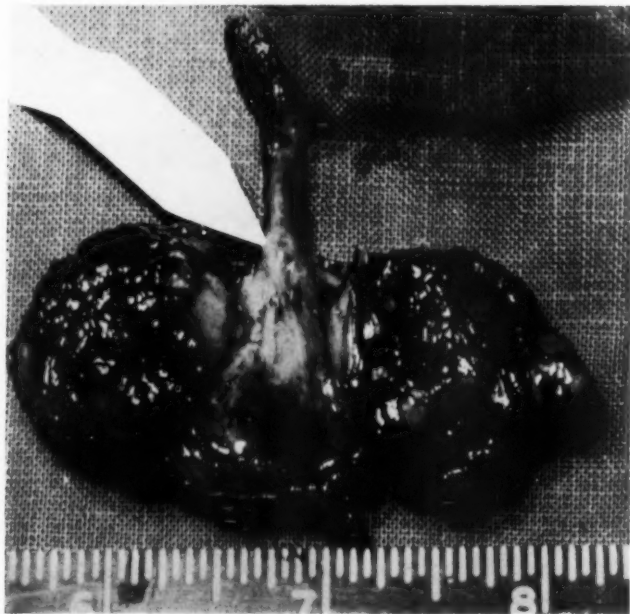


Fig. 5. Photograph of enucleated prostate with one and a half inches of accidentally avulsed urethra.

THE EVOLUTION OF SAFETY IN PROSTATECTOMY

In the writings of many eminent authorities care for the verumontanum and triangular ligament is very apparent, and this is true of the descriptions given by Wilson Hey (1945), Clifford Morson (1948), Riches (1950), and Welis (1953). In the Fuller-Freyer operation as described by Lowsley and Kirwin (1944) on the other hand the verumontanum is the most distant point the finger endeavours to reach, and it is stated that a short finger may not be able to attain it. Consequently, according to the description, the gland may have to be grasped and torn away bringing with it some or all of the verumontanum mucosa.

The discussion so far has centred around transvesical prostatectomy with brief reference to the perineal route.

Other approaches to the prostate

In 1904 Heusner described a most destructive infra-pubic approach involving considerable removal of bone. At this stage the patient collapsed and the operation was continued ten days later, but it was considered that "with a stronger patient the operation could be done in one section."

Couvelaire and Bouffard (1951) described in great detail an approach through an incision crossing the sacro-coccygeal junction and displacing the rectum laterally.

For our present purposes, however, neither of these approaches appears to have made any direct contribution to the safety of the operation.

Retropubic operations

The retropubic route which is now so widely used was slow in achieving popularity. Van Stockum (1909) published a most convincing and temperate account of two successful retropubic operations and envisaged the possibility of prostatectomy with closure. Maier (1924) reported four cases in which the approach was through a long inguinal incision, and in reaching the prostate he encountered some difficulty with the tying and severing of a mighty venous plexus. Jacobs and Casper (1933) illustrated the disposition of the pubo-prostatic ligaments and reported three cases.

Just as it had been left to Freyer to popularise the transvesical operation, and to Harris to establish intra-urethral enucleation, so it was left to Millin to achieve wide acceptance of the retropubic operation, the safety of which has been tested and approved by many surgeons in many countries in the last ten years.

The attractions of the operation are direct access, better visualisation of the prostatic cavity, preservation of an intact bladder wall, and shorter convalescence. For disease confined to the prostate the range of applicability is probably wider than with the transvesical operation, and certainly so if total prostatectomy is included.

The principal disadvantage is venous bleeding from the capsular veins, which cannot be easily avoided without abandoning the transverse incision, which gives the operation its true extravesical character, in contrast to the vertical incision of the vesico-capsular operation. There is also the

relative inaccessibility of intravesical lesions through this approach; and Marco Caine (1953) has shown that persisting deformity of the prostatic cavity is more common after the retropubic operation.

Following the introduction of the Millin operation some disquiet was felt among early exponents, because of a feeling that incontinence, prostatic stricture, and osteitis pubis were very much more common than after the transvesical operation. There seems little doubt, however, that Scholl (1950) was correct in sensing a lessened incidence of osteitis pubis, and the extent of this lessening suggested very strongly that, whatever the exact aetiology, the incidence bore some sort of relationship to the retropubic operation as such, and to its early history. Of the various theories of causation discussed by Mortensen (1950) trauma (and especially periosteal trauma) is one factor which might be expected to lessen with experience.

Less is heard now of the complications of incontinence and stricture, but it is believed that the classical descriptions of the Millin operation (1947, 1953) were capable of being misinterpreted to mean severance of the urethra close to the triangular ligament with some risk of damage to urethra and muscle (Fig. 5).

It is suggested that these risks are materially lessened by applying the technique of intra-urethral enucleation to the retropubic operation, both in description and in practice.

PRESENT PRACTICE IN RELATION TO SAFETY

Clinical assessment

The history and examination in prostatic surgery are especially connected with accurate clinical evaluation of the patient, and upon this the safety of operation will depend. Dealing with the sixty to eighty-year-old group of patients it will be possible to recognise good, average and bad risks. Bad risks in public hospital practice are many, and the selection of these cases for operation calls for precise clinical judgment. An unfortunate selection will result in mounting morbidity and mortality, while an ideal selection will keep the mortality down and confer surgical benefit on the maximum number of patients capable of being helped. Poor renal function, decreased cardiac reserve, and urinary infection will as a rule be recognised readily in the initial clinical examination.

The size of the prostate can be accurately recorded in the way described by Adams (1951), or more simply by the following rough and ready classification which has proved very useful with frequently changing house surgeons:

- 0 Absence
- 1 Normal
- 2 Slight enlargement
- 3 Moderate enlargement
- 4 Great enlargement
- 5 Extreme enlargement



Fig. 6. Excretion cystogram of a small fibrous prostate. The X-ray report suggested gross prostatic enlargement.

If we turn to John Hunter (1788) we find that he also possessed very clear ideas about prostatic size :

"This can be done by introducing the finger into the anus, first oiling it well, placing the forepart of the finger towards the pubes, and if the parts as far as the finger can reach are hard, making an eminence backwards into the rectum, so that the finger is obliged to be removed from side to side to feel the whole extent of such a swelling, and it also appears to go beyond the reach of the finger we may be certain the gland is considerably swelled and is the principal cause of the symptoms."

Pre-operative investigations

Pre-operative investigation includes where possible estimation of the blood urea, urine culture and sensitivity tests, and an intravenous pyelogram with an excretion cystogram and visualisation of any residual urine.

Radiological investigation of the size of the prostate is, however, not without difficulty, and in some cases the conclusions drawn can be quite fallacious (Fig. 6).

Management of retention of urine

In the management of retention of urine with which we have been concerned in one way or other in 74 per cent. of our cases, it has first to be accepted that cases of acute retention fall into two categories :

- (a) Those needing relief prior to admission ;
- (b) Those admitted to hospital without prior catheterisation.

In the former category we are concerned partly with environmental circumstances, but more importantly with policy in regard to undergraduate and post-graduate teaching. In teaching and practice it is a choice between the two alternatives of suprapubic catheter drainage with trocar and cannula, and urethral catheterisation. It will be agreed that our handling of this matter is vitally concerned with the safety of operative treatment.

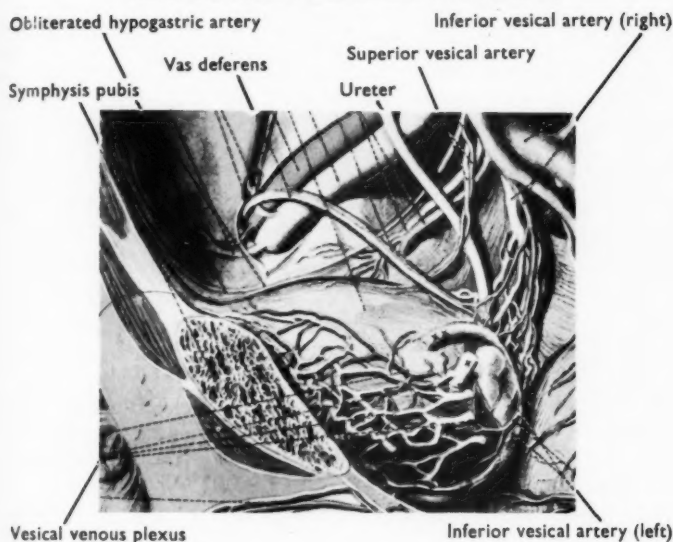
The difficulties encountered with the policy of suprapubic catheter drainage have been firstly to be certain of the level of skill and experience on the part of practitioners, and secondly at the time of operation a sense of anxiety regarding the presence of the small but infected cystostomy wound.

Because of these two difficulties a policy of urethral catheterisation is preferred. The objections to this are well grounded and respected—the inevitable risk of urethral infection being the most obvious, but a further objection is the comparative rarity of a blameless technique in aseptic catheterisation. Nevertheless, it is felt very strongly that urethral catheterisation is the method of choice for the relief of retention both in and out of hospital ; and, that being so, it is our responsibility to ensure that the teaching of the necessary technique is effective.

We have next to consider the safe handling of the patient admitted to hospital with unrelieved retention of urine. It is our custom in an over-worked hospital with frequently changing residents to have a fixed routine. After a complete physical examination a specimen of urine is despatched to the laboratory for culture and sensitivity tests. An immediate blood urea estimation is requested and the urinary tract is X-rayed to exclude stone. Catheterisation is then undertaken in the theatre by a registrar with full aseptic technique, and the catheter is tied in. Operation is carried out at any convenient time within the next thirty-six hours. A faster tempo than this is considered unsound practice, because as someone has wisely said, there are too many important associated conditions which can be missed if the journey from receiving room to theatre is too short. A slower tempo as often as not means infection. Slow decompression is used in cases of chronic retention.

This policy, of course, differs little from that in many clinics, and there appears to be fairly uniform agreement that the dividends in the form of

THE EVOLUTION OF SAFETY IN PROSTATECTOMY



(Sobotta)

Fig. 7. Male bladder showing blood vessels, ureters, and vasa deferentia.

lessened mortality and morbidity have been very considerable. Within our own knowledge, the mortality has dropped by two-thirds in twenty years, and the average stay in hospital has decreased by nearly half.

If the blood urea nitrogen is over 40 mg. per cent., and especially if there are uraemic symptoms, catheter drainage is continued for seven to ten days under chemotherapeutic cover before operation is undertaken, and in 4.5 per cent. of our cases a two-stage operation has been employed. In our clinical material we have been impressed with the very real danger of immediate operation in this type of patient.

Safety factors in operative technique

The results of prostatectomy have improved progressively because of better pre-operative and post-operative care, better anaesthesia, better control of fluids and electrolytes, ready availability of blood transfusion, better understanding of thrombosis and embolism, and, above all, better control of infection. Chemotherapy, however, is no substitute for the meticulous asepsis which Wilson Hey advocated so effectively, and which should surround every detail of management. For all these aids we are indebted to the generations of surgeons who preceded us, and to multitudes of workers in other fields.

The safety of the patient is dependent also on a developed and detailed operative management rather than on the specific value of some named operation.

We are always interested in one another's surgical habits, and some of my own are submitted merely as a basis for the discussion of certain relevant matters, and as the background against which the present study was undertaken.

A very meticulous skin preparation of the abdominal wall and genitals in one area is followed by a triple zone arrangement of sterile towels to provide for cystoscopy, urethral instrumentation, and operation respectively. Routine ligation or section of the vas deferens was omitted during the present series of cases in the over-optimistic belief that prevention of epididymitis was being adequately achieved by chemotherapy. This policy has been reversed in the light of the figures shown in Table II,

TABLE II INCIDENCE OF EPIDIDYMITIS	
1932	19.5 per cent. (vas deferens not ligated)
1938	2.2 per cent. (vas deferens ligated)
Present series	6.3 per cent. (vas deferens not ligated)

and ligation of the vas deferens has been reintroduced either subcutaneously in the neck of the scrotum or extra-peritoneally from the abdominal incision (Fig. 7). Cystoscopy with the patient lying flat on the table is carried out in all cases, and a rubber catheter is inserted as a guide.

Through a transverse skin incision and a vertical incision of the linea alba a wide exposure is secured with the aid of a Millin self-retaining retractor. Under modern conditions a wide exposure provides gentle and efficient access in the most difficult circumstances, and is a most valuable aid to safe surgery. This is in contrast to the rather limited exposure employed by Harris.

After the insertion of two stay sutures the prostatic capsule is incised transversely, and the incision is deepened and shortened until the urethral wall is exposed lying in its prostatic tunnel (Fig. 8). The urethra is then

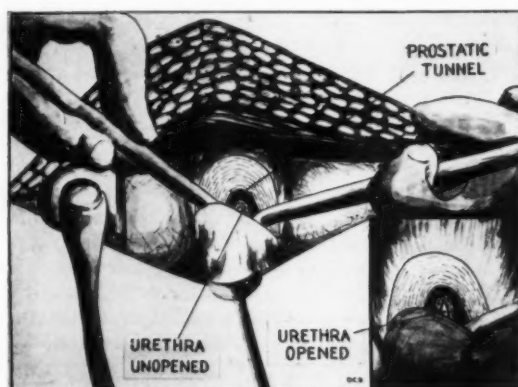


Fig. 8. Method of exposing the urethra by a transverse incision preparatory to intraurethral enucleation.

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incised to expose the rubber catheter which is removed, and under vision the index finger is inserted, and the internal meatus is examined for the presence of an intravesical projection or stenosis. Alternatively in a large soft adenomatous prostate after incising the prostatic capsule the index finger will often reach the prostatic urethra merely by gentle separation of the lateral lobes in the midline.

Enucleation of the prostate is then proceeded with according to the method of Harris, as distinct from the original description by Millin, but without the assistance of a finger in the rectum. The right index finger breaks through the urethral mucosa immediately on the postero-medial aspect of the distal pole of the left lobe, and the distal pole and remainder of the lobe are gently enucleated. The right lobe is treated likewise using the left index finger from the right side of the table in difficult cases. The verumontanum and the mucosa distal to it are left *in situ*, the mucosa being torn through immediately proximal to it, so linking the postero-medial enucleation planes of the lateral lobes. The two lateral lobes are now delivered through the capsular incision while remaining attached by the middle lobe and the urethral mucosa to the internal sphincter.

Under direct vision separation from the internal sphincter is completed, and the cuff of urethral mucosa at the bladder neck is divided. The specimen removed will then consist of the lateral lobes linked by the middle lobe with a very marked distal concavity previously occupied by the verumontanum (Fig. 9). It constitutes an accurate cast of the inverted U-shaped cavity remaining (Fig. 10).



Fig. 9. Prostate removed by intraurethral enucleation showing the distal concavity previously occupied by the verumontanum.

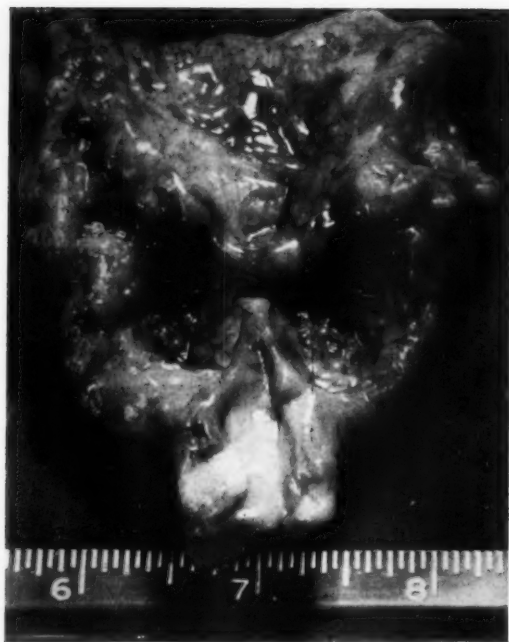


Fig. 10. Photograph of post-mortem specimen of bladder and urethra opened from the front illustrating the usual intra-urethral method of enucleation. It will be noted that the verumontanum and the posterior urethral wall distal to it have been left intact. The overhanging ledge at the posterior margin of the internal meatus is excised as described in the text.

If the middle lobe is absent or diminutive each lateral lobe may happen to be removed separately leaving the posterior urethral wall intact and in continuity with the trigone (Figs. 11 and 12).

The bladder neck spreader is then inserted, and the posterior lip of the internal meatus is everted with a blunt instrument (Fig. 13). The lip is grasped with sponge holding forceps, and the contained wedge of tissue is excised with cutting diathermy in all cases.

Attention is then directed to haemostasis using diathermy sparingly and accurately. A urethral vessel is specially sought posterolaterally on each side, and in some instances a suture will have been inserted in the meatal rim posterolaterally as in the Harris operation prior to excision of the wedge. Arteriograms of the inferior vesical arteries in post-mortem specimens confirm the soundness of the postero-lateral suture (Fig. 14).

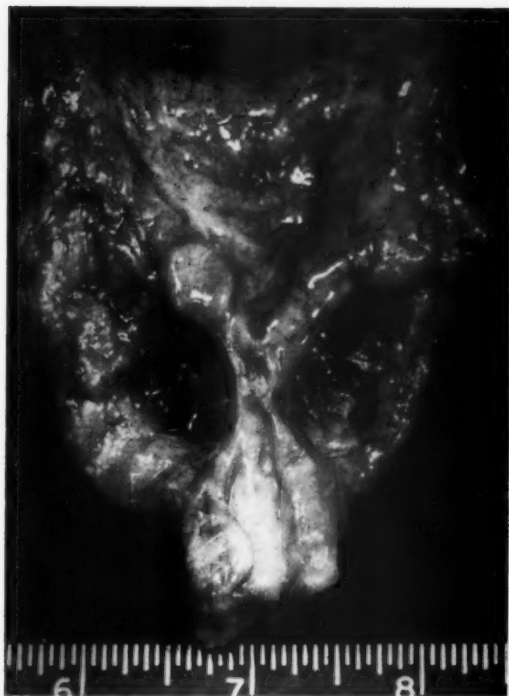


Fig. 11. Photograph of post-mortem specimen of bladder and urethra opened from the front illustrating the intra-urethral method of enucleation when the middle lobe is diminutive. The posterior wall of the urethra is intact. It is necessary to remove a wedge from the posterior meatal lip as in a normal enucleation.



Fig. 12. After enucleation of the lateral lobes when the middle lobe is diminutive the posterior urethral mucosa is often left intact.

We have not as yet considered prelusive ligation of the inferior vesical artery using the obliterated hypogastric artery for a guide as recently suggested by Henry (1954) (Fig. 7).

A number twelve Harris whistle tip catheter is inserted proximally along the urethra into the bladder, and its position accurately checked. A Foley catheter is more comfortable for the patient and less irritating to the urethral mucosa, but at times the rather soft wall causes difficulty in aspiration of clot. The capsular incision is then closed with No. 1 chromic catgut using two needle holders if necessary and a small Mayo needle. The boomerang needle which has given good service both in the Harris and Millin operations has been abandoned in favour of a gentler technique. The Cave of Retzius is drained with a strip of corrugated rubber and the urethral catheter is sutured to the penile skin, the sutures encircling the catheter and not piercing it, the glans penis being protected by a piece of gauze.

The alternative method of suspending the tip of the catheter to the abdominal wall involves transgression of the anterior bladder wall by a suture, which is a denial of the extravescical principle of leaving the bladder wall intact. There is no doubt that a temporary urinary fistula can be the price of such denial. The bladder is then irrigated with a Toomey syringe, and 30cc. of 4 per cent. sodium citrate are left in the bladder, and the catheter is occluded by a spigot.

Blood loss

The average blood loss during prostatectomy has been accurately measured by a number of workers and for retropubic prostatectomy has been variously given as 493cc. (Goldstein and Rubin, 1948), and 640cc. (Goodyear and Beard, 1949). This is about double the figure given by the same authors for transvesical operations, the difference being no doubt due to bleeding from capsular veins. Even though the blood loss is usually much less than these figures suggest, inspection of the sucker bottle, and the swabs, at the end of each operation will justify the routine administration of 600cc. of blood in all cases.

The fibrous prostate

It has been our experience that the fibrous prostate and bladder neck sclerosis can be dealt with very satisfactorily by the retro-pubic route; and this is fortunate because of the relative inaccuracy in our hands of the cystoscopic recognition of these conditions. It will be seen in Table IV that a clinical diagnosis of fibrous prostate was made in 4 per cent. of our cases whereas histological examination revealed an incidence of 9.4 per cent. The combination of a long history in a relatively young patient with a small prostate suggests a diagnosis of fibrous prostate. In the present series the average age of these patients was sixty-four years compared with sixty-seven years for the whole group. In some cases chronic retention with a huge atonic bladder may be encountered.

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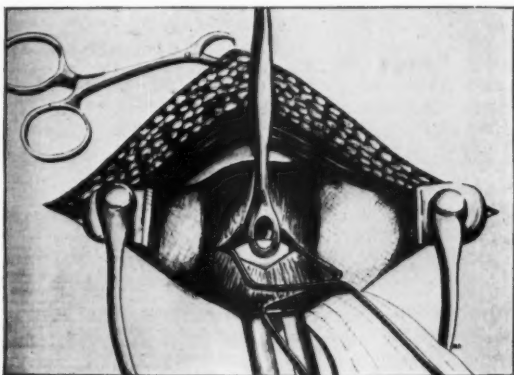


Fig. 13. Posterior lip of the internal meatus held in sponge holding forceps after enucleation of the prostate and prior to excision of wedge.



Fig. 14. Oblique view of post-mortem arteriograms of both inferior vesical arteries showing the rationale of the Harris postero-lateral sutures.

G.B. aet. sixty-eight years had chronic retention of urine and a blood urea nitrogen of 71.4 mg. per cent. The bladder occupied the whole abdomen, and eighteen pints of urine were withdrawn in the first twelve hours. A large diverticulum was removed, one ureter was reimplanted and a wedge was excised from the bladder neck. In an endeavour to restore the detrusor action of the bladder wall an ambulant Foley catheter was worn for three months, and at the present time he feels and looks well, and voids easily, but the blood urea nitrogen remains at 29 mg. per cent.

Whether diagnosed before operation or not, the encountering of a fibrous prostrate at open operation by the retropubic route involves no serious change in plans. A wedge is removed from the posterior meatal lip with due regard for the ureteric orifices and the lateral lobes are extensively removed with a cutting diathermy loop. Adequate removal of the constricting lateral lobes is necessary for the complete relief of obstruction, and can be readily accomplished under direct vision in the retropubic operation. This step is somewhat more difficult by the transvesical route, and is not infrequently omitted altogether.

Whether the fibrous prostrate is treated by transurethral resection, transvesically, or by the method described, it is suggested that the employment of suitable operative procedures for these cases has contributed very materially to the lowering of mortality and morbidity rates.

POST-OPERATIVE CARE

Management of the indwelling catheter

The indwelling catheter provides drainage by gravity, in contrast to the inefficiency of the suprapubic tube which preceded it. The care of this catheter is an art which has been developed since the introduction of the Harris operation and transurethral resection. It is a pivot on which the whole technique of modern post-operative management depends, and there is no aspect of surgery in which trained and experienced nursing is more necessary.

In the first twelve hours the judicious employment of the Toomey syringe and 4 per cent. sodium citrate solution effectively maintains the patency of the catheter. When free drainage is established the catheter is connected to a sterile bedside bottle. Washouts as such are not used, but syringing is employed of necessity if the catheter becomes blocked.

A "Fourth Ureter"

An essential part of the management of the indwelling catheter is to maintain continuous and uninterrupted drainage during the period of post-operative bleeding to reduce to a minimum the dangers associated with catheter blockage. This can be accomplished by dilution of the blood by constant irrigation through a three way catheter of the Bardex type; or through what Adams (1951) has picturesquely called a "third ureter" which is a ureteric catheter inserted beside the urethral catheter or suprapubic tube. In the present series the same end has been sought by the routine employment in all cases of an intravenous drip as a "fourth

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ureter" in the first twelve to twenty four hours. The "third ureter" compensates for, while the "fourth ureter" overcomes, "Nature's post operative oliguria"! There can be no doubt of the advantage of some such expedient in all prostate operations, and especially those involving catheter drainage of a closed bladder.

The indwelling catheter is removed on the fifth or sixth post-operative day.

Review of clinical material

The clinical background of the present study is a personal series of 222 consecutive prostate operations (Table III). The average age of the patients was 67 years and of these one quarter were over the age of seventy-five. As already stated the average age of the fibrous prostates was sixty-four. The classification according to the anaesthetic risk will be seen, and for the sake of comparison the same classification has been used in the "follow up" data (Table IX). Because of the high incidence of retention of urine, and because of the policy of management, it is understandable that 67 per cent. were catheterised after admission, and 15 per cent. prior to admission. A proportion of the patients came from medical and surgical wards where the occurrence of retention or the desirability of prostatectomy had arisen in the course of some other disease involving protracted confinement to hospital. These cases are of necessity reflected in the average length of pre-operative catheter drainage, and in the average stay in hospital.

TABLE III

PARTICULARS OF PRESENT SERIES OF CASES

Number of patients submitted to prostatectomy	222
Average age	67 years
Number of cases over seventy-five years ..	57
Average age of fibrous prostates	64 years
Suffering from retention of urine	74 per cent.
Anaesthetic risk :	
A. good	3.1 per cent.
B. fair	57.6 per cent.
C. poor	28.8 per cent.
D. very poor	3.6 per cent.
Average duration of pre-operative treatment :	5 days
Catheterisation before admission ..	15.5 per cent.
Catheterisation after admission ..	76 per cent.

*Average duration of pre-operative indwelling catheter

*Average stay in hospital

*Including cases of protracted hospitalisation from other causes.

Pathological diagnosis

In Table IV is presented a comparison between the pathological diagnosis as made clinically, macroscopically and microscopically; and a fairly exact correlation between the three is shown. For ease of comparison a single small palpable nodule felt on rectal examination and suspected to be carcinomatous has been classified as occult carcinoma, and during operation a small suspicious spot during the enucleation of

an adenomatous prostate has been classified similarly. Attention has already been drawn to the 4 per cent. incidence of fibrous prostate on clinical diagnosis rising to 9.4 per cent. under the microscope. The incidence of carcinoma was 7.6 per cent.

TABLE IV
PATHOLOGICAL DIAGNOSIS

Pathological type	Clinical	Macroscopic	Microscopic
Adenomatous	198 (89 %)	187	178 (80.1 %)
Carcinoma	13 (5.8 %)	12	11 (4.9 %)
Occult carcinoma	1 (0.45 %)	1	6 (2.7 %)
Fibrous	9 (4 %)	18	21 (9.4 %)
Adenomatous plus inflammatory ..	1 (0.45 %)	4	6 (2.7 %)

Bacteriology

In Table V an attempt has been made to tabulate the data contained in a vast mass of laboratory reports on specimens of urine, and it must be accepted that any conclusions drawn are of a somewhat tentative nature. Urinary infection was present in about one third of the cases on admission, the least common organism being the *B. proteus* and the most common coliform organisms. Sensitivity tests showed that only 7.2 per cent. of the organisms were sensitive to penicillin while 40.5 per cent. were sensitive to chloromycetin due no doubt in part to the high incidence of coliform organisms and *Ps. pyocyanea*. In thirty-five selected cases it will be seen that on discharge there was an increased incidence of staphylococci and *Ps. pyocyanea* confirming the clinical belief that in overcrowded surgical wards cross infection in all open wounds including the drained bladder is almost inevitable. With the increased incidence of these two organisms is seen a lessening of the number of organisms sensitive to penicillin and an increase in the number sensitive to chloromycetin. Conclusions as to the importance of acquired antibiotic resistance in prostatic surgery would necessarily require more detailed figures. It should be stated that appropriate chemotherapy including sulphamezathine was used in all cases; and it is suggested that a sulpha drug should be included in all sensitivity tests.

In our preoccupation with chemotherapy it is sometimes forgotten that, in chronic cases especially, acquired resistance to infection can still be of decisive importance. Some such thoughts were no doubt in Thomson-Walker's mind when he said in his Lettsomian Lectures (1930):

"If one accepts infection as a necessary sequel to prostatectomy the two stage operation has the advantage that the preliminary stage of infection is passed through before the prostate is removed, and possibly some degree of immunity to sepsis may develop before the second operation."

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Nevertheless, in prostatic surgery sepsis is to be feared above all else, especially in the patient with poor renal function; and almost all our efforts must be directed to the elimination, so far as possible, of bacterial infection before, during, and after operation. Gross cross infection which can occur so readily is a constant reproach to our surgical management.

TABLE V
BACTERIOLOGY

		222 Cases on admission	35 selected Cases On admission On discharge	
Microscopic	Pus Blood	71 95	25 33	11 13
Culture	Organisms present	69 (31.1%)*	24	19
	Staphylococcus	22 (31.9%)**	4	13***
	Coliform	32 (46.4%)	11	14
	<i>B. proteus</i>	9 (13.0%)	0	2
	<i>S. faecalis</i>	22 (31.9%)	7	9
	<i>Ps. pyocyaneas</i>	13 (18.8%)	7	14***
Sensitivity	Penicillin	5 (7.2%)	4	2***
	Streptomycin	19 (27.5%)	5	8
	Chloromycetin	28 (40.5%)	15	23***
	Aureomycin	19 (27.5%)	8	14
	Terramycin	17 (24.6%)	9	11
	Erythromycin	13 (18.9%)	7	12
	Neomycin	8 (11.5%)	6	6

* Percentage of 222 cases.

** Percentage of 69 infected cases.

*** Figures referred to in text.

Number and mortality of operations

In Table VI the operative mortality is shown according to the type of operation, the mortality for the retropubic operation being a little less than that for the transvesical. In 188 open operations the mortality was 4.7 per cent.

The cases submitted to transurethral resection were mainly cases quite unfit for operation, and the mortality of 17.6 per cent. was correspond-

TABLE VI
NUMBER AND MORTALITY OF OPERATIONS

Type of operation	Number of operations	Deaths	Mortality
Transvesical ..	77	4	5.2%
Retropubic	111	5	4.5%
T.U.R.	34	6	17.6%
TOTAL	222	15	6.7%
Two stage	10 (4.5%)	0	0

ingly high. Many of these cases should have had no more than a permanent suprapubic cystostomy, but it is felt that this is often unacceptable in modern society.

Incidence and mortality of operations for retention of urine

In Table VII it will be seen that retention of urine was the indication for operation in 74 per cent. of our cases, and that the operative mortality in this group was 7.8 per cent. compared with 3.5 per cent. in the cases without retention. When the cases of retention were subdivided into three groups the mortality for acute retention was 6.1 per cent., for chronic retention 10.5 per cent. and for retention complicating other conditions, 20 per cent. These figures clearly support Riches's (1950) teaching that the mortality is doubled in cases of retention.

TABLE VII
INCIDENCE AND MORTALITY OF OPERATIONS FOR RETENTION OF URINE

Classification	Number	Deaths	Total cases of Retention	Total Deaths
Acute retention ..	131 (59.0%)	8 (6.1%)	165 (74.3%)	13 (7.8%)
Chronic retention	19 (8.5%)	2 (10.5%)		
Retention complicating other disease ..	15 (6.7%)	3 (20%)		
Patients without retention ..	57 (25.8%)	2		2 (3.5%)
TOTALS ..	222	15		15 (6.7%)

Post-operative complications

In Table VIII are set out exceedingly briefly some of the important complications. The 6.5 per cent. incidence of epididymitis has already been referred to, and it must be stated again that ligation or section of the vas deferens was not carried out in these cases. Osteitis pubis was encountered in one case only, namely a transvesical operation. A complication which has caused some concern is post meatal stricture which occurred in 5 per cent. of the cases. There is fairly general agreement that it has increased in frequency, and that the reason for this is obscure. The factors to be considered include the size of the catheter in relation to urethral calibre, the duration of catheter drainage and associated urethritis, chemical irritation by certain types of red rubber (Handfield-Jones and Lewis, 1952), and altered tissue response to infection as a result of chemotherapy (Kirkland, 1955). Post meatal stricture is of serious importance only if neglected, and in only two cases was repeated dilatation necessary.

The 4.9 per cent. incidence of haemorrhage included any minor reactionary or secondary haemorrhage which received mention in the progress notes. The majority were of slight degree.

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TABLE VIII
COMPLICATIONS

Osteitis Pubis	0.45 per cent.
Haemorrhage (including lesser grades) ..	4.9 per cent.
Uraemia	4.5 per cent.
Epididymitis	6.3 per cent.
Medical	12.6 per cent.
Post Meatal Stricture	5.0 per cent.

"Follow-up" results in 100 cases

Apart from the early "follow-up" in nearly all cases a number of patients were communicated with by interview or questionnaire during the preparation of this lecture. The results are given very briefly in Table IX. The incidence of both obstructive symptoms and partial incontinence is shown to be low. Crystal clear urine is the most important indication of a satisfactory operation and it is significant that cloudy urine was recorded in only 9 per cent. The average day and night frequency of micturition was less than expected. The rough assessment of the general condition, although probably revealing a rather optimistic approach to the classification employed, may nevertheless be taken to indicate an improvement in health in those surviving prostatectomy, and perhaps, in part, survival of the fittest.

TABLE IX
FOLLOW-UP RESULTS IN 100 CASES (QUESTIONNAIRE AND/OR INTERVIEW)

Slight reduction in stream	4
Average frequency	D4/N2
Cloudy urine	9
Slight lack of control	4
Offensive urine	3
General condition :	
A. good	71.6 per cent.
B. fair	9.5 per cent.
C. poor	2.7 per cent.
D. very poor	1.2 per cent.

SUMMARY AND CONCLUSIONS

1. In the evolution of safety in prostatectomy in the first half of this century the introduction of the Harris operation stands out as an historic landmark.
2. At the present time the retropubic operation seems to have a greater range of application for purely prostatic conditions than any other operation.
3. With a transverse capsular incision it is the ideal operation for the fibrous prostate.
4. The serious complications of the retropubic operation have lessened in an interesting and peculiar way, and special reference is made to post-meatal stricture.
5. A plea is made for the teaching and practice of intra-urethral enucleation in the retropubic operation.
6. In post-operative management an intravenous drip for twenty four hours prevents the dangers of catheter blockage.

7. Urethral catheterisation and early operation is the policy favoured in acute retention.
8. An increased awareness of the effects of sepsis on damaged kidneys, and of the complex bacteriological problems involved, has contributed to better prevention and better control of infection.
9. In a personal series of 222 cases the mortality of open operation was 4.8 per cent. and excluding retention 3.5 per cent.
10. In 131 cases of acute retention the mortality was 6.1 per cent.
11. Safety, like perfection, may be approached but not attained.

ACKNOWLEDGMENTS

In conclusion, I wish to humbly acknowledge the great honour which the Council of the Royal College of Surgeons of England has done me, and my teachers, and my hospital by inviting me to give this Lecture.

I would record also my gratitude to my colleagues Mr. L. J. T. Pellew, Mr. D. S. Kidd, and Mr. L. Hoare for their help in many ways, and to my Registrar, Mr. W. A. Macbeth, who undertook the whole of the case analyses.

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PROFESSOR FRANCOIS L.-P. DE G. D'ALLAINES, Clinical Professor of Surgery in the University of Paris.

PROFESSOR C. F. W. ILLINGWORTH, C.B.E., Regius Professor of Surgery in the University of Glasgow.

DR. CHARLES W. MAYO, of the Mayo Clinic, Minnesota.

PROFESSOR HERBERT OLIVECRONA, Professor of Neuro-surgery at the Royal Caroline Medico-Surgical Institute, Stockholm.

Professor Crafoord will be admitted at the Meeting of Council on Thursday, 13th March.

Professor Illingworth and Professor d'Allaines will be admitted at the Diploma Granting Ceremony in the Great Hall on 11th June. Professor Olivecrona will be admitted at the time of the meeting of the International Federation of Surgical Colleges in Sweden on 4th July. Professor Cole and Dr. Mayo will be admitted at the meeting of the Council on Thursday, 10th July.

ANATOMICAL MUSEUM

THE SPECIAL DISPLAY for the month of March consists of a demonstration of the artists of the Hunterian Museum (Part II).

THE SURGICAL ASPECTS OF THE LYMPHOMATA

Lecture delivered at the Royal College of Surgeons of England

on

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by

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INTRODUCTION

IN THE CORNER of medicine of which this lecture treats confusion of terminology has further confounded a subject already intrinsically obscure. For this reason, any lecturer on "The Lymphomata" should start by defining terms. The term is reserved for those disorders which declare themselves by cellular proliferations of lymphoreticular tissue, often throughout the body, and which usually assume the clinical guise of generalised enlargement of lymph-nodes, liver and spleen. The lymphomata may be regarded as neoplastic, in that their cause is unknown and the cellular proliferations are progressive, purposeless, unrestrained and superfluous to the needs of the organism; but, by stricter histological criteria, only some examples qualify for the description of malignant.

The terms "reticulosis" and "reticulosarcoma" are often used in this connection: in general, "reticulosis" may be said to embrace the lymphomata which do not present the histological features of malignancy, and "reticulosarcoma" those which do. These two terms however convey an additional meaning, for they carry with them a notion of histogenesis. Those who employ them believe that there is a group of related disorders resulting from systematised hyperplasia of primitive mesenchymal cells, or of their derivatives, with subsequent specific differentiation. Thus in lymphatic leukaemia, the differentiation is towards the lymphocyte, and in Hodgkin's disease, towards myeloid and collagen-forming cells. In the "reticulosarcomata" this proliferation is accompanied by the histological hall-marks of malignancy—stromal destruction and infiltration. The term "reticulosis," although devised by Letterer as long ago as 1924, has been given its present connotation largely by the work of Pullinger (1932) and of Robb-Smith (1938). In this lecture, I shall use "reticulosis" and "reticulosarcoma" in the senses I have indicated. I do this in spite of the pontifical denunciations of Lumb (1954), who has declared that this usage is a prostitution of the terms, by which he appears to mean that anyone not accepting his definitions is guilty of a misdemeanour.

Classification of reticulosis and reticulosarcoma

There has been much alteration over the classification of these diseases in the past twenty years. At one extremity are those who believe that the histological patterns presented are unstable and inconstant, changing from one to another in the same patient. For them classification is simple, for they recognise only one type of "lymphoma," the appearances of

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which are variable, but of no importance. At the other pole are the morbid anatomists who have attempted a precise subdivision of these disorders according to their histological characters, who believe that the patterns are constant, and that, with a few well recognised exceptions, metamorphosis does not occur. In short, they hold that there are several well-defined morbid processes to be recognised, which pursue their individual and predictable courses. Representative of this second group is the classification of Robb-Smith (1938), which I have followed for many years and which I believe to be helpful to the clinician who is trying to plan treatment and essay prognosis.

A short digression into morbid anatomy is required to understand this problem. Classification is founded upon the histological changes to be seen in the excised lymph node: normally these bodies consist of a reticulin mesh work enclosed within a fibrous capsule, and divided into sectors by fibrous strands running from the hilum to the periphery. The interstices of the meshwork are filled by lymphoid tissue. In the subcortical area, globular aggregations of densely packed lymphocytes, disposed around a central arteriole, form the lymphoid follicles; sinuses, lined by specialised histiocytes, accompany the fibrous trabeculae from the subcapsular sinus to anastomose in the hilum. These three structural zones, and medulla, the follicles and the sinuses, often react individually in disease, and proliferative processes may primarily affect only one. It is possible to recognise, therefore, reticuloses which are of sinus, medullary or follicular origin and, in Robb-Smith's classification, the terms are descriptive first of the region in which the hyperplasia begins and secondly of the type of proliferated cell. The varieties recognised are set out in the accompanying Table (Table I). Some reticulosarcomata have a follicular pattern at the outset, but it is usually impossible to distinguish a starting point, and the qualifications used are merely descriptive of the cell type (Table II).

TABLE I
CLASSIFICATION OF THE RETICULOSES
(Robb-Smith)

- A. *Follicular reticulosis*
 - (a) Lymphoid follicular reticulosis
- B. *Sinus reticulosis*
 - (a) Lipomelanotic reticulosis.
- C. *Medullary reticulosis*
 - (a) Haemic medullary reticulosis :
 - (i) Myeloid.
 - (ii) Lymphoid.
 - (iii) Monocytic.
 - (b) Fibromyeloid medullary reticulosis.
(Hodgkin's disease).
 - (c) Lympho-reticular medullary reticulosis.
 - (d) Histiocytic medullary reticulosis.
 - (e) Reticulum-cell medullary reticulosis :
 - (i) Of infants (Letterer-Siwe).
 - (ii) Of adults.

There is no need for prolonged discussion of the nature and aetiology of the lymphomata. For many years sterile arguments have taken place on this topic. Their cause is unknown and the view taken of their nature

depends upon definition of terms. All agree that the reticulosarcomata are neoplastic in every accepted sense of the word. They present certain peculiar features depending upon the nature of the lymphoreticular tissue which is not confined to one anatomical site, but widespread throughout the body, and, because this tissue characteristically reacts as a whole, the neoplastic process is often multicentric or systematised. It has already been said that the reticulososes can reasonably be regarded as malignant diseases if cancer is defined in terms of disordered cell behaviour, but not if the rigid criteria of static morbid anatomy are used.

TABLE II
CLASSIFICATION OF THE RETICULOSARCOMATA
(after Robb-Smith)

1. Undifferentiated reticulosarcoma.
2. Differentiation to tissue cells :
 - (i) Dictyosyncytial.
 - (ii) Dictyocytic.
3. Differentiation to blood cells :
 - (i) Lymphoblastic.
 - (ii) Lymphocytic.
 - (iii) Plasmocytic (Myeloma).
 - (iv) Myeloblastoma (Chloroma).
4. Polymorphic reticulosarcoma (Hodgkin's sarcoma).

Surgical aspects of the lymphomata

I turn now to the manner in which these diseases may be of particular interest to the surgeon. It can be accepted that their general management lies in the hands of the physician, but there are many occasions on which surgical help is required. These include diagnostic and therapeutic situations which will require separate discussion for the individual diseases, but there are some general aspects of diagnosis which may first be considered.

The majority of these patients come under observation because of enlargement of lymph-nodes, and for this reason may well be referred for surgical opinion. The possible causes of such enlargement are myriad and cannot be considered in detail : they fall into three categories : the reactive-inflammatory group, metastatic malignant disease, and the lymphomata, which are our present concern. It would be inappropriate here to discuss the clinical aspects of differential diagnosis. In general, there is an evident cause in the first two groups ; when none is apparent, or where other features suggest that the disease is one of the lymphomata, precise diagnosis always demands histological examination of an excised lymph-node, unless examination of the blood has established the case as one of leukaemia. The importance of biopsy cannot be exaggerated ; without the knowledge it gives, treatment cannot be planned rationally, no estimate of prognosis can be made, and the management of the patient will be fumbling and uncertain throughout his illness.

There are, perhaps, certain points about biopsy of lymph-nodes to which a physician may reasonably draw the attention of surgeons. The whole aim of the procedure is diagnostic and it is thus of the first importance to obtain a representative node. To this end, it is wise when possible

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to avoid those from the upper deep cervical or inguinal groups, for they have almost always been the seat of previous reactive changes, and the resulting fibrosis makes histological interpretation difficult. Small nodes at the periphery of an affected group are unsatisfactory, because they often show only reactive hyperplasia. Biopsy of axillary lymph nodes is sometimes followed by troublesome haematoma formation, and this group should be avoided if an alternative offers. On occasion, when the node which lies about the centre of the sternomastoid muscle is excised, damage to the accessory nerve may result, particularly when there is much peri-adenitis. Where possible, two or three lymph nodes should be removed intact through an incision which is not designed solely with a view to the cosmetic result.

The leukaemias

I propose now to discuss the more common lymphomata and the ways in which they may concern the surgeon. The leukaemias fall within the definition of reticulosis and their frequency gives them pride of place. Acute leukaemia can be dismissed rapidly. In occasional instances, some unusual node of presentation may bring such a patient to the surgeon before diagnosis is established. Perhaps the most frequent is a haemorrhagic episode such as haematuria, less commonly the severe bone pain experienced by some children with acute lymphoblastic leukaemia arouses a suspicion of acute osteomyelitis; sometimes infection of the subcutaneous tissue or upper respiratory tract is the initial event. These diagnostic pitfalls can only be circumvented by cultivating an awareness of their existence and by contemplating the individual patient as well as the individual lesion. Examination of the blood will always show some suspicious abnormality, although bone-marrow study may be required before the diagnosis can be firmly established.

Chronic myeloid leukaemia is so easily recognised that it has little relevance to the present discussion. Sometimes the splenomegaly is mistaken for some other abdominal tumour, and a surgical opinion sought; here a blood count will always reveal the true situation. Occasionally, when priapism is the first symptom, a urologist is consulted. In a proportion of patients the initial event is the sudden appearance of a hernia or a uterine prolapse. It is reasonable to suppose that the increase in pressure within the abdomen due to splenic enlargement may precipitate such mechanical disturbances. Careful examination of the abdomen to exclude splenomegaly will avoid the occasional operative catastrophe from this cause.

The only complications of this disease which have surgical importance are those due to skeletal infiltrations. They have been noted in about 7 per cent. of my patients. The commonest is a destructive lesion at the upper extremity of the femur or humerus, but in two there were solitary bone tumours leading to pathological fracture, one at the lower end of

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the femur (Fig. 1), the other at the upper end of the tibia. Effusions into joints and particularly the knees may be seen.

Chronic lymphatic leukaemia is a more common disease and will concern the surgeon more frequently than the other varieties. It may present in some unusual fashion: recurring septic infection and repeated attacks of tonsillitis are both common. The second is of particular importance to the laryngologist, because such patients are often referred



Fig. 1. Osteolytic lesion at lower end of femur causing spontaneous fracture in a patient with chronic myeloid leukaemia.



Fig. 2. Osteoporosis with collapse of fifth lumbar vertebra in a patient with chronic lymphatic leukaemia.

to hospital for tonsillectomy. A history of recurrent tonsillitis with marked tonsillar hypertrophy in an elderly patient should always arouse suspicion of lymphatic leukaemia.

In about 7.5 per cent. the patient seeks advice first for the presence of a solitary lymph-node mass. In two of my patients this tumour was within the abdomen. Skeletal infiltrations occur in about 5 per cent. of patients. The most common lesion is an osteoporosis of the vertebral column, affecting particularly the lower dorsal and lumbar regions (Fig. 2). Vertebral collapse is common and in one patient resulted in compression of the cord and paraplegia. This radiological appearance is reminiscent of the diffuse decalcifying type of myelomatosis. Local bone tumours are less common but have been observed in the head of the tibia.

Patients with chronic lymphatic leukaemia are particularly prone to the development of haemolytic anaemia, often of sufficient severity to threaten life. The frequency of this complication has only recently been recognised.

It is of the auto-immune variety and antibodies against the patient's own red blood cells are demonstrable in his serum by direct or indirect methods. In many instances therapeutic response to the steroid hormones is satisfactory, but in others the possibility of splenectomy has to be considered. This operation is indicated if the steroid hormones have failed, or are for some reason contra-indicated, and if it seems probable that the leukaemic process itself will not prove fatal for a reasonable length of time. In about one-third of patients the results are satisfactory. Splenectomy may be justifiably considered in those occasional patients with an indolent form of the disease, but with splenomegaly so massive that life is rendered intolerable.

Hodgkin's disease

Hodgkin's disease may be regarded as a medullary reticulosis in which differentiation is towards myeloid and fibril-forming cells. It is one of the most common of the lymphomata, but remains rare, having caused only

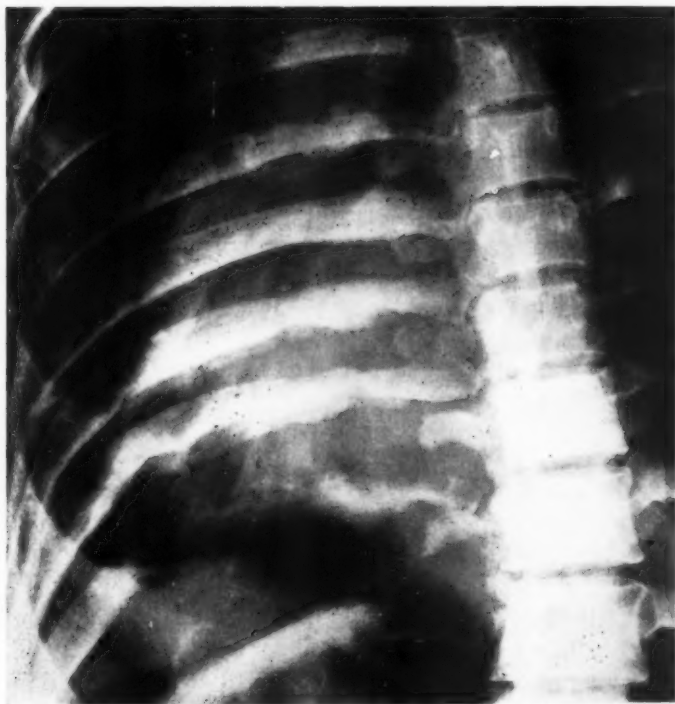


Fig. 3. Osteolytic lesions of the ribs in a patient with Hodgkin's disease.

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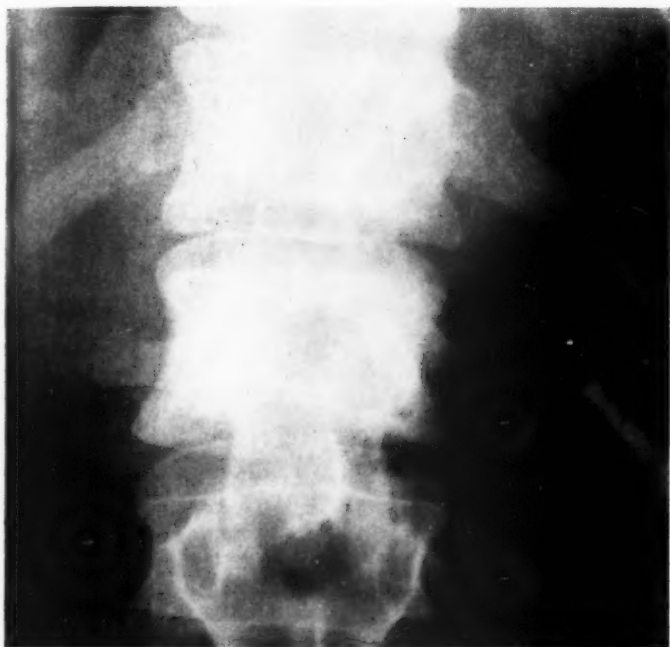


Fig. 4. Osteoplastic lesion of first lumbar vertebra causing " ivory vertebra " in a patient with Hodgkin's disease.

779 deaths in England and Wales in 1955, compared with 2,224 due to leukaemia. The clinical pattern of the disease is well known : it may occur at any age, but is most frequent between twenty and forty years, affecting males somewhat more often than females. Three out of four patients present with painless enlargement of cervical lymph nodes ; but in more than half of these radiography shows simultaneous affection of those within the mediastinum. Less commonly the primary site of the disease is in one of the other superficial groups, in the mediastinum, or within the abdomen. In the early stages general health is preserved, but, with the passage of time, other nodal groups are invaded ; there is enlargement of the spleen and liver ; symptoms of general intoxication make their appearance ; and, after a course varying in length from a few months to more than ten years, the patient dies anaemic, febrile and cachectic.

Although this general pattern is pursued with constancy, variations occur in the length of the course and the site of infiltrations. Of particular interest to the surgeon are those in unusual organs or tissues which give rise to misleading symptoms. They usually occur late in the disease and

thus do not occasion diagnostic difficulty ; but, when the primary localisation is unusual, the clinical picture may be confusing. Isolated splenomegaly was the presenting feature in two of our patients ; in another, a mass in the nasopharynx brought him to the doctor ; and, in a third, obstructive jaundice was the initial event. There is probably no organ or tissue, with the exception of the substance of the brain and the spinal cord, in which infiltration with Hodgkin's disease has not been recorded.

The skeletal lesions have a particular surgical significance. They are almost always noted late in the illness ; indeed, it is in those patients in whom the disease runs a prolonged course that these, and other less common, manifestations are prone to occur. Occasionally sternal tumour is the presenting symptom and is usually associated with disease in the mediastinum. In the later stages the incidence of skeletal infiltrations has been put as high as 20 per cent. and post mortem studies suggest an even greater frequency. The bones most commonly affected are the vertebrae, the sternum, the pelvis, the ribs, the skull and the upper extremities of the femora and the humeri. Sometimes there is direct extension from lymph-



Fig. 5. Osteolytic lesion of fourth lumbar vertebra in a patient with Hodgkin's disease.



Fig. 6. Osteolytic lesion of a dorsal vertebra with collapse associated with paraplegia in a patient with Hodgkin's disease.

node masses ; this is noted especially in the lumbar spine when processes from diseased nodes within the abdomen may enter the extradural space through intervertebral foramina and give rise to compression of the cord. Sometimes periosteal deposits invade underlying bone, a form of lesion often seen in the ribs (Fig. 3) and humerus. In the spine osteoplastic changes are common, producing the appearance known as "ivory vertebra" (Fig. 4) ; less frequently osteolytic lesions with vertebral collapse (Figs. 5 and 6) may be seen and these are liable to be associated with compression of the cord.

The paraplegia of Hodgkin's disease may be due to one of several lesions. In many cases radiography will show no bony disease, and in these the probable cause is extension from prevertebral deposits ; in others, vertebral collapse is noted. The appearance of signs suggesting compression of the cord constitutes a therapeutic emergency ; irradiation should be undertaken immediately, preceded by the administration of nitrogen mustard. The length of vertebral column irradiated should extend several inches above and below the level of compression, because the extradural lesions are frequently much more extensive than the physical signs indicate.

The therapeutic contribution that surgery may make in Hodgkin's disease is limited. The value of excision as a definitive method of treatment

is not yet decided. There is some evidence that, when disease is limited to one superficial group of lymph nodes, radical extirpation may be followed by many years without recurrence and possibly even by "cure." There are many practical difficulties in assessing the value of such treatment and in deciding when it is suitable. It would be justifiable only when disease is limited to the superficial lymph nodes in the upper half of the neck on one side; about one patient in twenty fulfils these requirements. Moreover, when the disease takes this form, the outlook is relatively favourable with radiotherapy, and from this group are drawn most of the examples of long survival whatever the treatment applied. The numbers available are so small that it is not yet safe to conclude that the mutilating operation of block dissection offers such patients a better chance than irradiation. My personal experience amounts to only five cases; one of these patients has survived for more than five years without signs of recurrence, but the other four all died within this period.

Recently the suggestion has been made that Hodgkin's disease is not a reticulosis but a form of malignant thymoma. It has been claimed that a primary thymic tumour can always be found if sufficiently diligent search is made, and there have been attempts to deal with the disease by thymectomy and removal of contiguous lymph nodes when its anatomical distribution is suitable. This view has gained little acceptance and the results of treatment based on this hypothesis have yet to be assessed.

Splenectomy may on rare occasions be indicated. An auto-immune type of haemolytic anaemia has been recorded in Hodgkin's disease, although it is less common than in chronic lymphatic leukaemia. Because it is rare the frequency with which it responds to steroid drugs is not yet known, but it is a reasonable assumption that it will follow the pattern of other secondary types of haemolytic anaemia. In one of my patients haemolytic anaemia with splenomegaly was the presenting syndrome; and it was only on histological study of the excised spleen that the true diagnosis was appreciated. Splenectomy was followed by a complete remission which lasted nearly four years. Occasionally profound leucopenia or thrombocytopenia appears to be associated with overactivity of an enlarged spleen, and sometimes these two blood changes are together accompanied by a mild haemolytic state in the picture known as splenic pancytopenia. When this situation arises the cytopenia forbids radiotherapy or chemotherapy and, provided the bone-marrow is active, splenectomy offers an escape from the therapeutic impasse. Operation will restore normal leukocyte and platelet levels and permit further treatment.

Lympho-reticular medullary reticulosis

Lympho-reticular medullary reticulosis is recognised under other names by several authors. It is known as Hodgkin's paraganuloma by Jackson and Parker (1947), as reticular lymphoma by Lumb (1954) and as benign Hodgkin's disease by Harrison (1952). About one patient with this

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disorder is seen for every six with Hodgkin's disease. It is primarily localised to one superficial group of lymph nodes and, after irradiation, no recurrence may occur for five or more years. It has a tendency to remain localised for a long period, but in a proportion of cases it undergoes frank reticulosarcomatous change with an abrupt increase in the tempo of the disease. Jackson and Parker and Lumb believe that the histological picture may change from a diffuse medullary proliferation of lymphocytes and reticulum cells, without eosinophilia or reticulin formation, to the typical appearances of Hodgkin's disease itself. Robb-Smith has not seen this metamorphosis, and it seems likely that the former include under this head cases which he would regard as Hodgkin's disease *ab initio*.

The surgical aspects of this disease are similar to those of Hodgkin's disease itself, although it may be argued that radical excision might here be a more justifiable procedure.

Histiocytic medullary reticulosis

Histiocytic medullary reticulosis is a rare disease affecting young and middle-aged adults. The excised lymph node shows a proliferation throughout its medulla of histiocytes and their immediate precursors; many of the mature forms resemble normal macrophages and often contain phagocytosed red cells or nuclear debris. The onset is acute or subacute with fever, prostration and loss of weight. Outstanding splenomegaly is common, but lymph-node enlargement is seldom more than moderate. Progressive anaemia is the rule and thrombocytopenia and leukopenia are common. Terminally, jaundice, apparently of haemolytic origin, and purpura are often to be noted. In one case recorded by Asher (1946) splenectomy resulted in remission lasting ten months.

Lymphoid follicular reticulosis

Lymphoid follicular reticulosis is widely recognised under at least twelve other names of which follicular lymphoblastoma and Brill-Symmer's disease are probably the most common. Its incidence is about one-seventh that of Hodgkin's disease; it occurs in middle age, and somewhat more frequently in men than in women.

The changes in the lymph-node are striking and characteristic. They consist of a proliferation of lymphoid cells and their precursors occurring in distinct nodular areas which give the node the appearance of being replaced by lymphoid follicles. The greater part of each follicle consists of small mature lymphocytes, while in the centre are a few more primitive cells resembling lymphoblasts. The normal structure of the node is compressed between these large hyperplastic follicles which displace the reticulin framework into surrounding rings.

The disease usually starts with enlargement of the nodes of one superficial group; less often there is generalised lymphadenopathy with splenomegaly and enlargement of the liver when the patient is first seen. Little change may take place for five years or longer and spontaneous remissions

are common. Sometimes isolated splenomegaly brings the patient under observation. The masses respond readily to irradiation, but after a period, which may be as long as ten years, the tempo of the disease is accelerated. Sometimes frank reticulosarcomatous change occurs; sometimes a leukaemic blood picture appears; and sometimes progressive lymphadenopathy, splenomegaly and enlargement of the liver lead to cachexia and death from exhaustion. Haemolytic anaemia is not rare and may afford an indication for splenectomy. With reticulosarcomatous degeneration skeletal deposits are common and may give rise to pathological fracture of long bones or to paraplegia. One of our patients had two episodes of intestinal obstruction from lymphoid masses in the small bowel.

Letterer-Siwe's disease, eosinophil granuloma and Hand-Schuller-Christian's disease

Reticulum cell medullary reticulosis is perhaps the best descriptive label for the last of these disorders and under this head must be included at least four clinical syndromes. First, reticulum cell medullary reticulosis of adults is a rare disease which runs a subacute course with fever, splenohepatomegaly and lymph node enlargement. Both the splenic and nodal enlargements may be massive. Biopsy shows a diffuse proliferation of non-phagocytic reticulum cells throughout the medulla of the lymph node. The few patients I have seen have responded poorly to irradiation and have survived for less than a year; in one instance splenectomy for a hypersplenic syndrome procured a remission lasting eight months. Its relationship to the other forms to be described is uncertain and indeed some authorities do not consider it a distinct entity.

The other three syndromes are now accepted as clinical variants of one pathological process; these are Hand-Schuller-Christian's xanthomatosis, eosinophil granuloma and Letterer-Siwe's disease. Transitional forms between these three have repeatedly been reported. Letterer-Siwe's disease presents the simplest pathological picture, for the lymph node is replaced by a medullary proliferation of pale-staining homogeneous reticulum cells. In eosinophil granuloma the picture is changed by the addition, sometimes in enormous numbers, of eosinophil leukocytes. In Hand-Schuller-Christian's disease the reticulum cells are phagocytic and many contain cholesterol in quantities sufficient to give them the typical "foam cell" appearance. All variants of these changes may be noted and in some patients all these may be found in material from different sites.

The acute form of the disease occurs in children and has long been known as the Letterer-Siwe syndrome or acute reticulosis of infants. The clinical features are an acute onset, with fever and loss of flesh, progressive anaemia, splenomegaly, enlargement of the liver, lymphadenopathy and a cutaneous eruption which is haemorrhagic and often infiltrated. Radiology may show a miliary infiltration of the lungs and defects in the ends

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of the long bones are common. Previously always fatal, apparent recovery has now been recorded after treatment with steroid hormones.

Eosinophil granuloma was first described in adolescents as a local affection of the skull (Fig. 7), long bones and skin. The individual lesions were recorded as healing after irradiation and sometimes spontaneously. During the past ten years it has been recognised as the most benign of these three syndromes, lesions appearing and resolving sometimes over a period of twenty years. Although skeletal deposits are particularly common, lymph node enlargement, miliary infiltrations of the lung, and diabetes insipidus are all reported. The appearances in the excised lymph



Fig. 7. Defects in skull bone in a patient with eosinophil granuloma.

node may bear a superficial resemblance to those of Hodgkin's disease and this diagnostic error was made in two of my patients.

Hand-Schuller-Christian's disease was originally regarded as a syndrome marked by exophthalmos, diabetes insipidus and defects in membranous bones. It is now known that many other sites may be affected by the process: hepatic enlargement, splenomegaly, lymph-node enlargement, infiltrations in the long bones and the vertebral column, and miliary mottling of the lungs have all been noted.

These three disorders present clear differences from other reticuloses, and it is doubtful whether they can justifiably be regarded as in the same sense neoplastic.

The reticulosarcomata

I must now draw your attention to the reticulosarcomata. These tumours are somewhat less common than the reticuloses, the Registrar-General's review showing them to have caused about as many deaths in 1955 as Hodgkin's disease. A number of different histological classifications have been suggested, but it has been general experience that, since clinical behaviour bears little relation to cellular type, these subdivisions have no value for the physician and some form of clinical classification is necessary.

The rate at which these tumours grow varies greatly, but it is possible to recognise acute and chronic varieties. The acute form may be systematised from the onset with general enlargement of lymph nodes, usually only moderate in degree, and spleno-hepatomegaly. There is fever, progressive anaemia and the early appearance of effusions into serous cavities. These patients sink rapidly and the course of the disease seldom exceeds six months. The individual masses are highly radiosensitive, but the disease is too widespread to make radiotherapy practicable. There

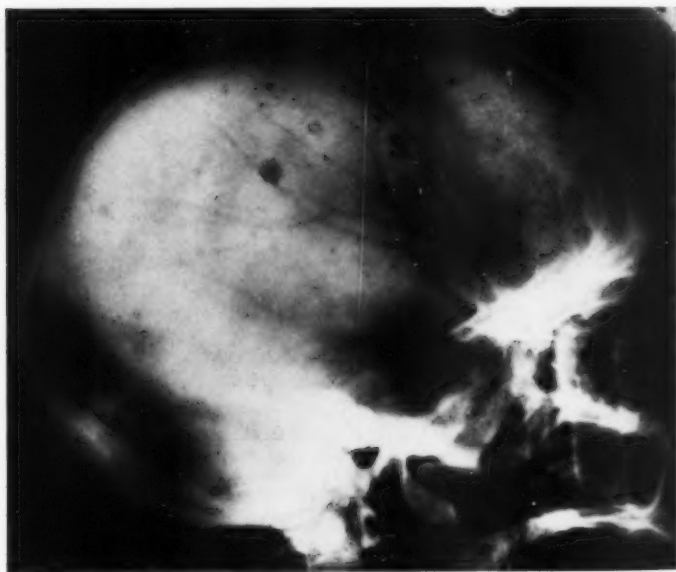


Fig. 8. Defects in skull bones with destruction of sella turcica in a patient with myelomatosis.

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Fig. 9. Destructive lesions of femora in a patient with myelomatosis.

may be transient improvement with steroid drugs or with chemotherapy. The less common acute type presents with a mass of enlarged lymph nodes in one group. On occasions its rapid growth results in necrosis and the physical signs suggest suppuration; fever and leukocytosis often lend

support to this view. I have, on several occasions, seen such swellings explored in the belief that drainage was required.

The dividing line between lymphoblastic reticulosarcoma and lymphatic leukaemia is hard to define. There is one familiar clinical picture, usually seen in children and young adults, where the patient first appears with a local tumour. This is most frequently mediastinal in situation, although in one of my patients it was in the naso-pharynx. For the first few weeks there are no significant changes in the blood; then suddenly, often within a few days, it is flooded with primitive cells and the picture changes to that of acute lymphoblastic leukaemia. This variant has long been known as Sternberg's leukosarcoma and it is commonly regarded as a type of acute leukaemia.

The chronic forms of reticulosarcoma are more common than the acute, and group themselves into those in which the tumour is primarily local and those in which it is partly or wholly systematised from the outset. Histologically the most frequent variety is the lymphoblastic reticulosarcoma (lymphosarcoma). The distinction of this tumour from lymphatic leukaemia is a matter of difficulty. Indeed, many authorities deny that it can be made, holding that lymphosarcoma is lymphatic leukaemia without the characteristic blood changes. There is certainly little difference between the two in the clinical picture at the onset.

The localised tumours are, however, much more likely to concern the surgeon, because of their mechanical effects. The syndromes they may provide are innumerable, depending upon their exact localisation. They may, perhaps, be grouped into those of superficial, and those of deep, origin. The former may sometimes originate in the deeper layers of the skin but more commonly present with enlargement of one superficial group of lymph nodes. Biopsy reveals the nature of the disease. Some of this type carry an excellent prognosis and it seems likely that, when possible, radical excision followed by radiotherapy is the treatment of choice.

Reticulosarcoma may arise anywhere, but there are certain areas which it favours. The lymphoid tissue of the upper respiratory tract, the stomach, the small intestine and the para-aortic lymph nodes are all familiar sites. Lymphosarcoma of the tonsil is a well-known and relatively common tumour. Reticulosarcoma of the stomach is well documented. The lesion is often solitary in the early stages and the results of gastric resection are surprisingly favourable, apparent cure having been recorded on several occasions. The small bowel tumours carry a far graver prognosis. They often lead to early sub-acute intestinal obstruction, and at exploration it is usual to find extensive disease of the bowel with general enlargement of the mesenteric and para-aortic lymph nodes. Resection is usually necessary for mechanical reasons, but even with subsequent irradiation the course is seldom prolonged for more than a year. In the large bowel, solitary lymphoma of the rectum is not rare, but occasionally a diffuse polypoid reticulosarcoma affects the entire colon. The diagnosis may be of great

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difficulty if the colon is the primary seat of the disease, the symptoms suggesting ulcerative colitis and the radiological appearances defying interpretation. Wide-field irradiation is the only therapeutic measure applicable. Retroperitoneal, splenic, and hepatic reticulosarcomata are



Fig. 10. General osteoporosis with vertebral collapse in a patient with myelomatosis.

all seen from time to time and often present diagnostic problems verging on the insoluble.

The final tumour to demand consideration is the plasma-cell reticulosarcoma or multiple myelomatosis. The apparent increase in the frequency of this disease is familiar to all and is only partially explained by more precise diagnosis. Such patients consult the surgeon with spontaneous

fractures of the ribs or clavicles or with vertebral collapse. The physician sees them on account of obscure anaemia or renal failure. Diagnosis depends upon the demonstration of plasma-cell proliferation in the bone-marrow. In many there is a great increase in the serum globulin level and in the erythrocyte sedimentation rate. In about 60 per cent. the urine contains Bence-Jones protein. The radiological changes are often characteristic in the later stages (Figs. 8 and 9), but may be misleading at the onset. Simple osteoporosis of the spine is a common appearance (Fig. 10); or one vertebral body alone may show disease. Suspicion of hyperparathyroidism may be aroused by the bone changes and supported by an increase in the serum calcium figure; and an erroneous diagnosis of metastatic carcinoma is frequent.

Treatment remains most unsatisfactory, although irradiation of solitary lesions is often followed by relief of pain and recalcification. The results of chemotherapy are disappointing.

CONCLUSION

This group of diseases—the reticulososes and the reticulosarcomata—is increasing in numerical importance. Their obstinate resistance to treatment, their inevitably fatal conclusion, and the many diagnostic and therapeutic problems they present account for the macabre fascination they exert upon workers in this field. In this brief and superficial survey I hope I have been able to show you something of the varied clinical forms the lymphomata may take and to point out the diagnostic pitfalls which await the surgeon who lacks at least a nodding acquaintance with them.

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DONATIONS

THE FOLLOWING GENEROUS donations have been received during the last month:

- £3,000 Mathilda Marks Kennedy Charitable Trust.
 Seven-year Covenant for £358 p.a. Marcus J. Sieff.
 Seven-year Covenant for £286 p.a. Michael D. Sieff.
 £250 The Harvey Tercentenary Congress.
 \$100 Dr. Loyal Davis.

Down House Fund:

- £1,000 The American Philosophical Society.
 £100 Josiah Wedgwood & Sons.

A MINOR HAND INJURY SERVICE *

by

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DURING THE LAST few years, at the London Hospital, a minor hand injury clinic has been organised within the structure of the accident and orthopaedic department.

The clinic functions on an out-patient basis and all surgery is performed under local anaesthetic in a special out-patient theatre. The type of case considered suitable for this out-patient care has already been described in a previous publication (Flatt, 1955) but generally it can be said that the object has been to treat cases in such a way that they can return to work immediately and receive their post-operative care as out-patients. It must be stressed that any case which is sufficiently bad to need in-patient treatment does not come under the care of the unit. That the cases the unit is responsible for are called "minor" is merely a means of distinguishing them from those "major" cases which need admission. In terms of working time lost these "minor" injuries are of greater importance than the more extensive, but less frequent, "major" cases.

Our major objective was to attempt to standardise the methods of diagnosis and treatment; and thereby allow a reasonably scientific assessment of results to be made. The basis of our teaching is to stress the importance of accurate diagnosis of the extent of the injury followed by the application of surgical principles to the lesions diagnosed. By stressing this approach we have found that students readily apply their knowledge to cases which do not easily fit into a particular diagnosis.

Accurate Diagnosis

The vital step in diagnosis is the classification of the lesion. To aid this a large wall card is permanently displayed with the standard classification illustrated by two examples of each type of injury (Fig. 1). This classification is repeated in the diagnostic section of the standard record cards which are used in the treatment of these injuries.

These cards are so designed that all relevant information needed in the diagnosis of the case is recorded on the front surface. The back is entirely devoted to treatment. The information required is, wherever possible, recorded by the alternative answer method so that if the card is filled in systematically no relevant information is omitted.

It will be seen from the reproduction of the card (Fig. 2) that a considerable amount of information is recorded in the upper third of the card. This portion is largely filled in by the lay staff before the patient is seen by the receiving room officer (R.R.O.); this doctor decides whether

*The major part of this Paper was presented before the annual meeting of the American Society for Surgery of the Hand at Chicago in January, 1957.



Fig. 1. The permanently displayed card which shows the standard classification of injuries.

the case is more appropriately treated in the infected hand clinic or in the accident department. He may well decide that the condition is so trivial that treatment may be given in the receiving room and that the patient need not attend the accident department.

All cases that are referred by the R.R.O. are seen by the accident officer. It is his responsibility to see that the record card is completed correctly and he pays particular attention to such details as recurrent accidents and whether or not the accident occurred at work.

The injury is classified both by recording the type of lesion and also by a brief drawing on the hand outlined on the bottom half of the sheet.

Above the desk of the accident officer is framed a large card entitled "Seven Essential Questions." These questions are designed to make him analyse his classification and diagnosis before he undertakes treatment.

SEVEN ESSENTIAL QUESTIONS

1. What is the *cut/crush* ratio ?
2. Is the wound *tidy* or *untidy* ?
3. Is there any *skin loss* ?
4. Are the *tendons* injured ?
5. Are the *bone* and *joints* involved ?
6. Is the *neurovascular bundle* injured ?
7. What is the patient's *occupation* ?

A MINOR HAND INJURY SERVICE

It was felt that if each of these questions were to be answered before treatment was planned or undertaken, then it would be possible to prevent disasters such as radical amputations being performed on the excuse of "tidyness" with no attention being paid to the occupational function of the sacrificed digit.

THE LONDON HOSPITAL		RECORD No.	
HAND CLINIC		87116*56	
		CARD PUNCHED	
		18 JUN 1956	
Name of Patient <u>SMITH, John</u>		RIGHT LEFT HANDED	
Address <u>15 FORD ROAD, TOTTENHAM</u>		Age <u>47</u> Male or Female	
Date and Time of First Attendance <u>4 MAY 1956 9.25 am</u>		Occupation <u>Lathe operator</u>	
If infected Yes <input checked="" type="radio"/> No <input type="radio"/>		Employer <u>W. & A. Smith & Co. Ltd</u>	
If so, how long _____ days		Injured at Work <input checked="" type="radio"/> Yes <input type="radio"/> No	
X-Rayed <input checked="" type="radio"/> Yes <input type="radio"/> No		Previous Similar Accident <input checked="" type="radio"/> Yes <input type="radio"/> No	
To <u>ACCIDENT DEPARTMENT</u>		If so, when <u>11 months ago</u>	
HISTORY <u>50 minutes ago dropped metal casting (15 lbs weight) onto thumb - ragged lacerations to nail root area + subungual haematoma. Comminuted fracture of terminal phalanx</u>		R.R.O.'s Initials <u>RJS</u>	
CLASSIFICATION OF INJURY			
Right: Palm/Dorsum	Thumb	Index	Middle
<input checked="" type="radio"/> Left: Palm/Dorsum	<input checked="" type="radio"/> Thumb	1. 4. 10. 12	Index
			Middle
			Ring
			Little
TYPE OF WOUND			
1. Crush	7. Skin Loss	13. Flexor Tendon Cut	
2. "Tidy" Incised	8. Amputation, Partial	14. Extensor Tendon Cut	
3. "Tidy" Sliced	9. Amputation, Complete	15. Digital Bundle Cut	
4. "Untidy"	10. Nail Bed Injuries	16. Joints Involved	
5. Thumb	11. Foreign Bodies	17. Discharging Pus	
6. Pulp Loss	12. Bony Damage	18. Tendon Sheath Involved	

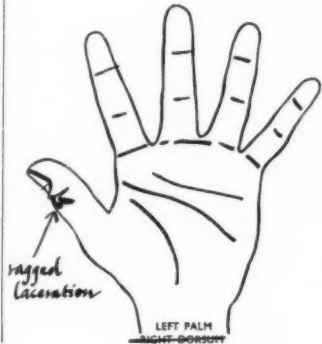
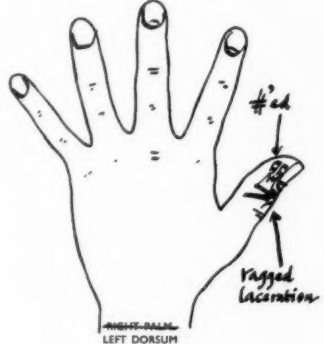



Fig. 2. The diagnostic side of the record card used in the Unit, with the relevant details of a case filled in.

PRINCIPLES OF TREATMENT

The wall card showing the "Classification of Injuries" is accompanied by a similar large card entitled "Generalisations on Treatment." This card enumerates certain principles, in a thoroughly dogmatic manner, under each individual type of injury.

Tidy wounds

Tidy incised wounds usually heal well if they are accurately sutured. If the edges are not at right angles to the skin surface then they must be trimmed before suturing.

Tidy sliced wounds

There may be a flap which can be sutured back but if there is much fat on it, be sure that there is adequate blood supply. If there is skin loss it must be replaced. There is no loose skin in a hand to allow "dragging together."

Untidy wounds

These wounds usually have several small, ragged narrow-based flaps which are likely to die. It is better to replace these by a good graft than to "hope they will live" and be faced subsequently by an infected wound. However, be judicious, wholesale sacrifice is not justified.

Skin Loss

Loss of epithelium from a digit or the palm must be replaced by new skin. The loose skin on the dorsum is deceptive; it is tight in fist-making and can only be used to a limited extent to rotate flaps. If rotation flaps are used the surgical defect created should be grafted.

Thumb wounds

The thumb is such a vital part of the hand that every effort must be made to keep its full length and to give its wounds immediate epithelial cover. Excessive trimming of a traumatic amputation, on the grounds of "tidiness," is *wrong*. Trimming of a thumb should only be done as a secondary elective procedure.

Pulp loss

To cover a finger tip which has lost its pulp with a split-skin graft is useless. It will never have proper sensation and because the cushioning of the pulp is missing it will be repeatedly damaged. A full thickness flap must be used.

Nail bed injuries

The nail is modified epithelium and where there has been actual epithelial loss by far the best dressing that can be used is skin. A split-skin graft cut thin at one end and thick at the other should be applied so that the thin part lies where the nail will grow over it.

Neurovascular bundle damage

A finger can survive on the blood supply of a single digital artery though there may well be some temporary venous congestion. A digital nerve is a pure sensory nerve and hence repair with 6.0 silk sutures at the time of injury usually gives very good results.

Foreign bodies

Apart from their actual removal these may well present problems by damaging deeper structures or by introducing infection; they therefore usually need exploration along their tracks.

Amputations

Partial amputation should always be sutured back if one neurovascular bundle is intact.

Complete amputation if through the tip only, can be sutured back. More proximal amputations should use a flap from the finger if possible. If not, then a thick split-skin graft must be used. In either case the hand must be elevated and the finger kept cool by using light dressings only.

Crush injuries

Injury by crushing must inevitably lead to oedema because there is *depth* to the injury. Sutures must, therefore, be put in loosely to allow for the swelling. The crushed part must have compression dressings to try to control the oedema and it must be elevated. It may be several days before local thrombosis and consequent necrosis defines the full area of the injury.

Tendon injuries

Flexor tendon injuries are a major surgical problem and are not suitable for out-patient surgery. The only primary treatment permissible is that designed to give intact epithelium through which definitive surgical repairs may be made.

Extensor tendon injuries on the dorsum can be repaired at the time of injury. Fine wire sutures must be used and there must be intact full thickness skin over the site of the tendon suture. Wounds of the tendons in the fingers are major problems: get advice before attempting any form of repair.

Display cards

In addition to the "Generalisations on Treatment" a series of six display cabinets contains cards dealing in some detail with the stages in treatment of various lesions and the appropriate methods of applying epithelial cover.

The first card in the series is designed to show the type of instruments that should be used in hand surgery and to banish any idea that a *laissez faire* attitude is acceptable in the surgical care of the hand.

The cards are entitled :

1. Operative technique.
2. Ragged lacerations.
3. Split-skin grafts.
4. Full thickness grafts.
5. Thenar flap.
6. Rotation flap.

The illustrations of the full thickness graft card are reproduced in Figure 3. The accompanying typescript reads as follows :

ACCIDENT : *Right hand caught in power belt machinery.*

INJURIES : *Thumb.*—Amputation at interphalangeal joint and avulsion of the tendon of flexor pollicis longus.
Ring finger.—Virtually severed through interphalangeal joint. Extensor tendon divided, flexor tendons intact. The neurovascular bundle on the ulnar side was intact.
Little finger.—Skin laceration.

OPERATION : *Thumb.*—A full thickness skin graft was cut from the amputated portion and sutured into place.

Ring finger.—Extensor tendons sutured and skin wound sutured.

Little finger.—Wounds dressed.

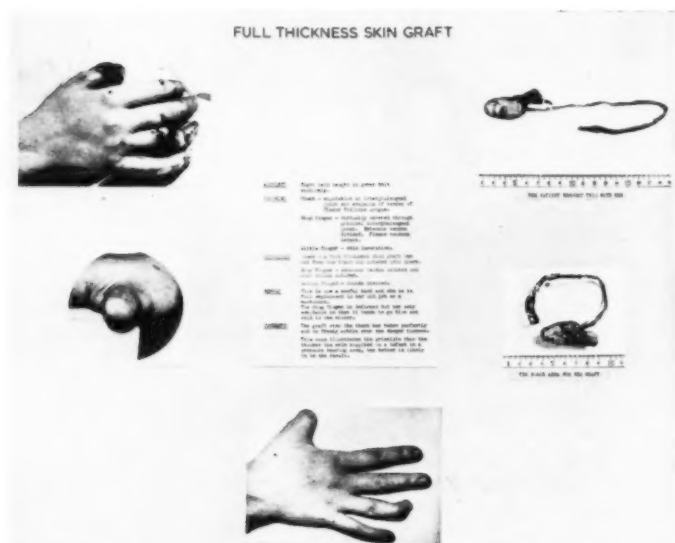


Fig. 3. One of a series of instructional wall cards. This example shows the steps in treatment when a full thickness graft is used.

PRIMARY TREATMENT

Middle: Nail trephined

Thumb and Index bandaged. No dressings to middle finger

Photographed. Yes/No ☒ No
If Not, Why Not? _____

Letter to Doctor. Yes ☒ No ☐
 No ~~First~~ Certificate Given.
 Signature *B. S. Jang*

FOLLOW-UP ATTENDANCES

DATE	CONDITION AND TREATMENT	CHEMOTHERAPY
MAY 18 1957	Reduced. All wounds clean. Given spare Tineguaz. Continue at work. See ⑤	nil
MAY 23 1957	Swelling has subsided in middle but tip still tender. All sutures removed. Thumb + index dressed See ⑤	
MAY 26 1957	healed. T.C.A. S.O.S.	

DAYS OFF WORK *nil*

FINAL CERTIFICATE GIVEN - / - / -

Fig. 4. The treatment side of a record card completed for the same patient as is recorded in Fig. 2.

RESULT : This is now a useful hand and she is in full employment in her old job as a machinist. The *ring finger* is deformed but her only complaint is that it tends to go cold in the winter.

COMMENT : The graft over the thumb has taken perfectly and is freely mobile over the deeper tissues. This case illustrates the principle that the thicker the skin supplied to a defect in a pressure-bearing area, the better is likely to be the result.

It will be seen from the treatment side of the record card (Fig. 4) that apart from the space allowed for the recording of the actual operative treatment there are several questions which have to be answered, e.g., "Photographed Yes/No." We believe that photography can play a useful part in recording results either for teaching or litigious purposes at some subsequent date and the question is, therefore, framed to make the accident officer think about its usefulness.

We feel it is important to keep in touch with the patient's own general practitioner and even though the hospital may be entirely responsible for treating the patient, a letter is always sent to the private doctor describing the treatment given.

The bottom of the card is completed when the patient is discharged from treatment and the relevant details are subsequently punched on to a code card for machine tabulation.

OPERATIVE TECHNIQUES

In general, the overriding principle taught is respect for tissues and their dislike of being sutured or bandaged under pressure. Fine plastic or ophthalmological instruments are used exclusively and in general monofilament non-absorbable sutures are used. The burial of catgut is discouraged. Anaesthesia is provided by the use of digital block (without the inclusion of adrenalin) and occasionally brachial plexus block has been used.

Dressings are restricted to the minimum and great use is made of Tube-gauz stockinette bandages. Patients with dirty occupations have the definitive dressings strapped into place and are given a few feet of Tube-gauz to take away so that they may replace the outer dressings when necessary.

Mobility is encouraged to the utmost and only rarely is some form of rigid immobilisation considered necessary; when it is indicated malleable aluminium strips padded with sorbo rubber are used.

Plaster of Paris is never used. Not only is its use very rarely indicated, but in addition we have found that employers happily accept back at work patients whose fingers are bandaged but should they attempt to return with a Plaster of Paris protection over the dressing they are considered a grave risk and employment is refused !]

RESULTS OBTAINED

As a means of presenting the results obtained by these methods, an analysis of one year's work has been carried out. So as to remove the risk of personal bias influencing opinion the year was chosen to coincide with the absence of the writer from the unit.

The cases have been rigidly selected and only those cases showing a traumatic epithelial lesion distal to the wrist have been included. Any wound which crossed the wrist was excluded from the series; cases in

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which a fracture was the major injury and the skin wound a secondary consideration were also excluded.

TOTAL CASES 292

Men	..	..	..	..	67.6 per cent. (197)
Women	..	..	..	..	23.5 per cent. (69)
Children (14 or less)	..	..	..	..	8.9 per cent. (26)

Eighty-eight per cent. of the men and 78 per cent. of the women were injured at work. 19 per cent. of the women were injured in domestic accidents while only 1 per cent. of the men injured themselves in any form of sport.

Occupational factors

Seven per cent. of all the cases had had similar previous accidents and two patients each reported over five similar injuries. The occupations of these two patients were dustman and glazier. Apart from these two cases, no real evidence of accident proneness was obtained. The occupations of the other cases were evenly distributed throughout many activities, namely, general labourer, domestic employment, hairdresser, counter-hand, barman, student, messenger, horse vehicle driver, glazier, book-binder, wood machinist, sawyer, beer bottler, tailor's machinist, tailor's cutter (2), engineer (2), tinsmith, dustman, furnaceman.

Chemotherapy

Prophylactic penicillin and anti-tetanic serum (ATS.) were considered in every case but only 29 per cent. of the cases were given some form of penicillin and 49.5 per cent. were given ATS.

In view of the dirty nature of the work of many of the patients, these figures may seem dangerously small but that they are justified is shown by the fact that the overall post-operative infection rate was only 0.54 per cent., a figure which is probably due more to careful surgical technique than the powers of penicillin.

Healing times

The longest time sutures were retained was twenty-three days (two cases); the shortest was five days (two cases) and the commonest time seven days (fifty-eight cases).

The longest time in healing was fifty-two days and the shortest four days. The average healing time for the whole series was 9.5 days.

Three cases failed to heal in under forty days. The longest time in healing, fifty-two days, was in a nine-year-old child who had a thenar flap performed to repair a complete amputation of a finger tip. The operation was ill advised and failed because inadequate immobilisation was followed by infection. The flap was detached and returned to the palm. The finger-tip took fifty-two days to heal by second intention and the result was indifferent (50 per cent.).

Both the other cases had complete amputations of a finger-tip and each took forty-two days to heal. One had a full thickness skin graft sewn

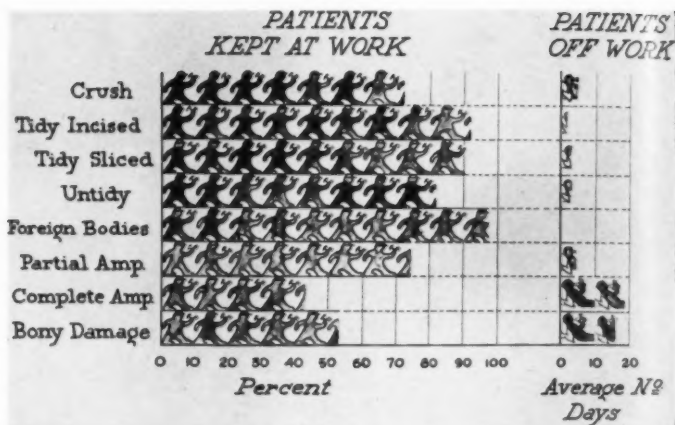


Fig. 5

into the defect. This graft at first appeared to fail completely but it seems that some of the deeper dermal elements must have survived as the final result showed a finger-tip with epithelium considerably thicker than would have been produced by ingrowth from the periphery of the wound. This was considered to be an 80 per cent. result.

The second case was that of a tailor's cutter who amputated his finger-tip down to and just including the tip of the phalanx. He brought the amputated specimen with him and insisted against all our pleading that it be sutured back in place. The result was a necrotic finger-tip which eventually healed in forty-two days to produce a result which could only be considered a 50 per cent. functioning finger-tip.

Recovery times

The degree of recovery is difficult to estimate but since every single case was returned to pre-accident employment it was felt that if they went back to work with no symptoms they should be considered a 100 per cent. recovery.

On this basis 96 per cent (280 cases) were considered to have a 100 per cent. recovery. Of the remainder, two cases were considered to have a 50 per cent. result ; six cases had 80 per cent. result and four cases 90 per cent. result.

Time off work

Since one of the main objects of the hand clinic is to cut down the loss of working time, it is gratifying to record that 86 per cent. (253 cases) were never off work during their treatment. Of those patients who were off work, the longest time was forty-two days and the shortest three

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days. These figures are further analysed in graphic recordings charted against the various diagnoses of the injury (Fig. 5).

Analysis of Treatment

If the treatment of the three commonest diagnoses—tidy incised, tidy sliced and crush is analysed, it can be seen that the vast majority were sutured as the primary treatment.

	Tidy incised	Tidy sliced	Crushed
Sutured	81	23	24
Dumbell sutures ..	8	1	
Split-skin graft ..		7	3
Dressing only ..	14	23	26
Splinting			6
Total.	103	54	59

Dumbell or adhesive plaster approximation sutures are used in children where acceptable closure of the wound can be obtained without the additional trauma of suturing.

The anatomical distribution of the wounds which were sutured and those which were grafted is shown graphically in Figure 6.

Split-skin grafts

Nineteen patients were considered suitable for their area of skin loss to be immediately replaced by a split-skin graft. Seventy-four per cent of

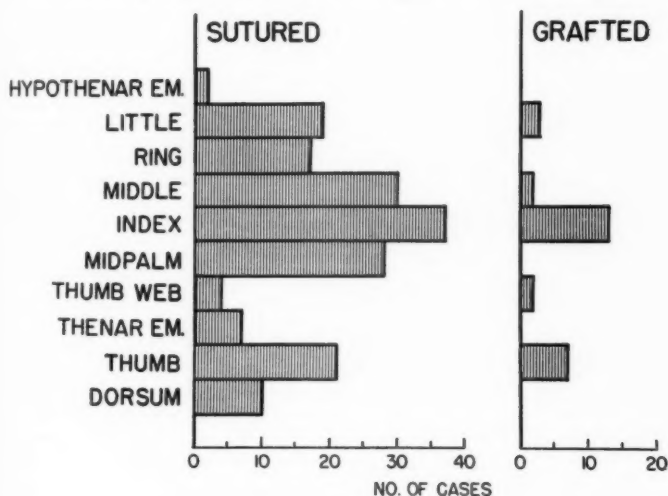


Fig. 6

these cases (fourteen patients) were kept at work throughout their treatment. In all cases the graft was sutured in place and the dressings were changed every four days. This policy was deliberately planned as an experiment and in this small series it would seem to be completely justified.

No graft failed completely, one case contracted a small degree of post-operative infection and three were judged to have been less than 100 per cent. successful, the assessments being 90, 80 and 75 per cent.

The average time off work for those who could not be immediately returned to work was 4.68 days.

Foreign bodies

Twenty-eight patients presented with foreign bodies for removal. These were usually sewing machine needles, metal twist drills, metal staples or small metal particles.

Forty-three per cent. of these cases (twelve patients) were given anti-tetanic serum and only seven per cent. (two patients) were given prophylactic penicillin. Only one patient was kept off work, for four days.

Sites of injury

If the results are broken down into the various types of lesion, their sum total is more than the total number of cases recorded.

This seeming inaccuracy is due to the fact that more than one lesion may be recorded for a single case. For instance, a crush injury may have recorded against it, untidy laceration, partial amputation, nail-bed injury, and bony damage.

Equally so the arbitrary anatomical areas may well be crossed, thereby recording two sites for a single lesion.

For this reason the figures quoted will be inaccurate and open to question. However, multiple lesions over several areas do occur and this analysis was felt to be the most suitable means of presentation.

Figure 7 shows the anatomical site of wounding in the hand charted against the number of cases of various types of lesions and Figure 8 shows

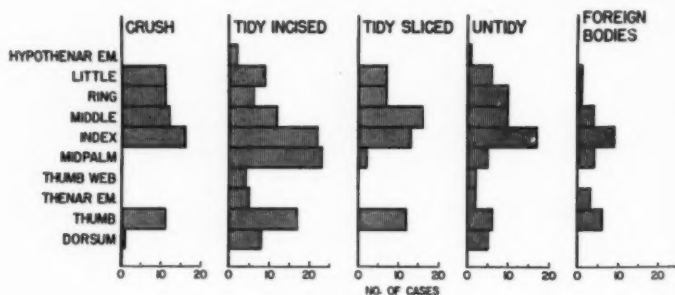


Fig. 7

A MINOR HAND INJURY SERVICE

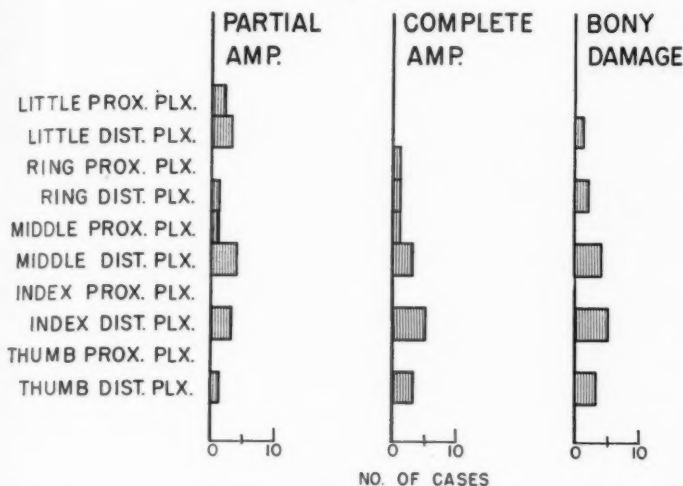


Fig. 8

the site of injury to the digit caused by varying degrees of bony damage and/or amputation.

Various industries tend to produce their own characteristic injuries and the majority of cases treated by the unit came from the tailoring, woodworking and light engineering industries. A study of these injuries shows that the borders of the palm, the hypothenar eminence, the thumb web and thenar eminence, are relatively immune from injury. In fact only two injuries occurred in the hypothenar area. One in a glazier and the other in a child who fell down at play. In contrast to the palm the border fingers were frequently injured. The area most at risk being the distal half of the index and middle fingers followed by the thumb and little finger; the ring finger was damaged the least of all.

Figure 9 is a model of a hand made to a scale proportional to the number of injuries in the various anatomical sites. The hypothenar area is of the same size as a normal adult hand.

COMMENT

In a previously published paper describing some of the work of the Unit in the years 1953-54, comment was made on the difficulty of obtaining really accurate figures of working time lost. There is still some difficulty over this but the results obtained have, in recent months, tended to impress the local employers sufficiently so that they are now readily accepting back at full work employees with bandaged hands.

Now that the conservatism of the employers has been overcome, we are finding that the opposition to return to work is coming from the

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patient. The common attitude is to assume that they are unable to return to work until they are "completely recovered." It is considered slightly unfair when it is pointed out that part of the treatment for an injured

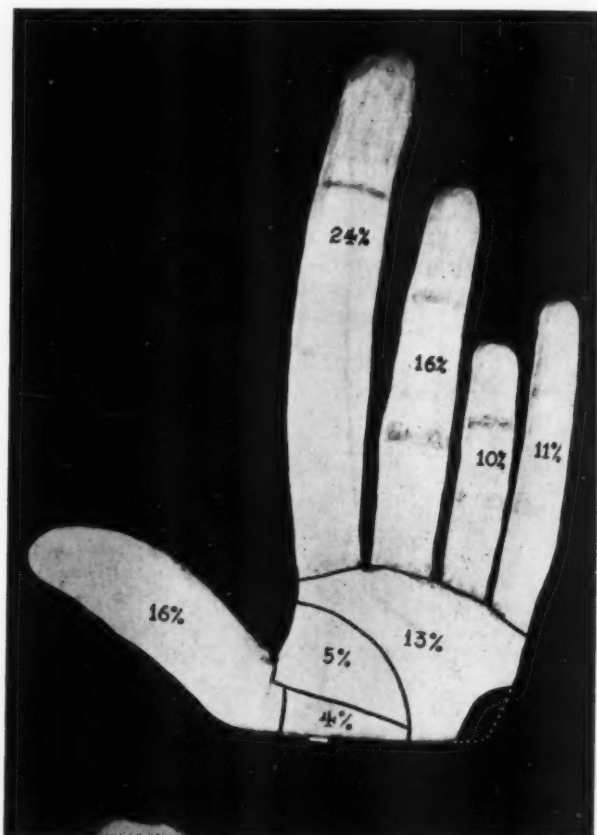


Fig. 9. An homunculus type hand with its anatomical areas proportional to the number of injuries they received.

digit is to maintain its mobility by use and that they cannot tell whether they are incapable of doing their work until they have tried it.

This reluctance to return to work is unfortunately frequently encouraged by various forms of benefit schemes whereby employees injured at work have their wages maintained while off work. There is no doubt that this is an equitable system but equally there is no doubt that such financial

security reacts unfavourably on the rehabilitation and return to work of many patients.

An additional factor that has to be overcome is what can best be called a tradition of disability; industries which tend to produce frequent injuries of a similar type have established a time quota for the injury which it is hard to break. For instance, workers in a certain foundry near the hospital are prone to crush injuries of the distal phalanges and when they sustain one are greeted by their workmates with remarks such as, "Good for you, Joe, that's worth a month off." As a result it is often extremely difficult to persuade Joe that it is in the best interests of both himself and his family that he should go back to work after three to four days.

Reviewing the work of the unit as a whole we feel that the various modifications we have introduced have led to an overall improvement in the care of the hand injuries from the area served by the hospital and that any further improvements will tend to come from the cooperation of our patients and their employers rather than from any great alteration in the medical care provided.

This service was organised with the active encouragement of Sir Reginald Watson-Jones and Mr. H. Osmond-Clarke.

It is felt that the basic plan of the Unit has been proved sound since a consistently high standard of care is being maintained despite frequent changes of staff. The results reported should be considered as those of the whole personnel of the Unit. The author is the mere chronicler of the results of this work but he would like to express this public appreciation of the unflinching cooperation of the personnel of the Unit throughout the time it has been in existence.

The photographs and wall cards were produced by Mr. R. F. Ruddick of the London Hospital photographic department. The graphs and hand models were done by the staff of Medical Illustrations of the State University of Iowa Hospitals.

REFERENCES

Because the work reported here is that of one particular Unit, the only references quoted are personal papers which express in greater detail various facets of this work. Appropriate references are quoted in these papers and for this reason it is hoped that their authors will consider this due acknowledgment of their publications.

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PRIMARY FELLOWSHIP EXAMINATION IN CEYLON

AT THE PRIMARY Fellowship examination held in Ceylon in January 1958, Sir Cecil Wakeley and Professor J. W. S. Blacklock were the visiting Examiners. Forty-five candidates presented themselves of which eleven were successful.

During the period of their visit, a special Convocation for the conferment of degrees was held in the University Theatre, Peradeniya, on 17th January, when the Chancellor of the University of Ceylon, His Excellency Sir Oliver Ernest Goonetilleke, conferred the degree of Doctor of Laws, *Honoris Causa*, on the Rt. Hon. Harold Macmillan, Prime Minister of the United Kingdom, and the degree of Doctor of Science, *Honoris Causa*, on Sir Cecil Wakeley.



The Rt. Hon. Harold Macmillan returning thanks for the Honorary Graduands. Left to right: Sir Cecil Wakeley, Sir Nicholas Attygalle (Vice-Chancellor), Sir Oliver Goonetilleke (Chancellor) and Mr. Macmillan.

APPOINTMENT OF FELLOWS AND MEMBERS TO CONSULTANT POSTS

CALBERT INGLIS PHILLIPS, F.R.C.S.

Part-time Consultant Ophthalmic Surgeon to the United Bristol Hospitals.

ROBERT ELMER HORTON, M.B.E., F.R.C.S.

Part-time Consultant Surgeon to the United Bristol Hospitals.

The Editor is always glad to receive details of new appointments obtained by Fellows and Members, either through the Hospital Boards or direct.

SIR HARRY PLATT, Bt.

M.D., M.S., F.R.C.S., F.A.C.S., LL.D.

Mr. Arthur Helfet, member of the Council, delivered the following citation when presenting Sir Harry Platt to the President on the occasion of his admission to the Honorary Fellowship of the College of Physicians and Surgeons of South Africa at the meeting of the full Council held in Durban on the 14th September 1957 :

It is MY privilege to present to you and to the Council for Honorary Fellowship of our College, Sir Harry Platt, Immediate Past President, Royal College of Surgeons of England, Honorary Fellow, Royal College of Surgeons of Canada, Honorary Fellow, American College of Surgeons,



Sir Harry Platt receiving the Honorary Fellowship of the College of Physicians and Surgeons of South Africa from Mr. Arthur Helfet.

Honorary Doctor of Medicine of the University of Berne, Honorary Doctor of Laws of the Universities of Manchester, Liverpool and Belfast.

It is our good fortune that circumstances have combined to afford us the privilege of having Sir Harry observe the first examinations for the F.R.S. (S.A.), for it brings to South Africa a Master Orthopaedic Surgeon in the direct succession to Hugh Owen Thomas and Robert Jones, who between them established this special branch of surgery. And so well did he and a handful of his contemporaries cultivate and nurture and teach the subject that three years ago the Royal College found it appropriate for Sir Harry to be the first orthopaedic surgeon to wear the insignia of

SIR HARRY PLATT

president. His selfless endeavours, over four decades, to promote the practice of orthopaedic surgery in its national sphere is reflected in his appointment as Consultant Advisor to the Ministry of Health and his chairmanship of many Government committees on post-graduate education and related fields. His qualities of statesmanship are evidenced by the harmonious relationships which characterise the International Society of Orthopaedic Surgery and Traumatology of which he is president.

Parallel to this record of achievement in public service runs his distinguished career as author, editor and, above all, as teacher in his own school, the great University of Manchester. It has with much truth been said that to be selected as assistant by Sir Harry was a hallmark in itself. His humanity and generosity of spirit to the young apprentice made him the most sought after, and then the life-long counsellor of many of the orthopaedic surgeons of to-day, and those fortunate enough to come under his spell were taught not only the craft and science of surgery, but also to read, to enquire and to do research.

Sir Harry's recreations are music and travel. We hope we shall not altogether fail him in respect of the latter. We bid Sir Harry and Lady Platt welcome and hope that they will enjoy their short stay in this beautiful South Africa.

The Council of the College of Physicians and Surgeons of South Africa has elected to award Sir Harry Platt the Honorary Fellowship of the College of Physicians and Surgeons of South Africa in recognition of his great professional services and honouring the Royal College in which he has held such high position and which he here represents.

Mr. President, and members of the Council, Sir Harry Platt.

THE 1957 CHARTER

ON THE 10th September 1957, Her Majesty the Queen gave her Royal Assent to the Supplemental Charter of the College, whose draft had been approved by the Privy Council in July.

This Charter, the tenth granted to the College, gives a number of additional powers which reflect the growing activities and responsibilities of the College.

The provision which affects Fellows of the College most intimately is that which permits the Council to require the payment of an Annual Subscription by all new Fellows, Fellows in Dental Surgery or Fellows in the Faculty of Anaesthetists. The amount of the subscription may be determined by the Council from time to time and has at present been fixed at five guineas, but it may not exceed ten guineas per annum without the consent of the Privy Council. The Council may require the forfeiture by any Fellow whose subscription is in arrear of all or any of the following rights or privileges:

1. Membership or eligibility for membership of the Council or a Board of Faculty;

THE 1957 CHARTER

2. The right to vote at Council or Board elections ;
3. The right to receive notice of and attend meetings of Fellows or Fellows in Dental Surgery or Fellows in the Faculty of Anaesthetists ;
4. The right to receive copies of the Annals free of charge (a right which the Council has agreed to extend to all Fellows paying a compulsory subscription).

At the same time the Council has been given the power to remit the compulsory subscription in whole or in part in cases of hardship.

The other provisions of the Charter, in the order in which they appear in the document are :

1. A provision giving the Council power to charge such reasonable fees as they may from time to time determine on election or admission to the Fellowship. The Charter of 1843 had previously limited the Admission Fee to Thirty Guineas, and although the Council has made no decision to increase the fee beyond this amount, it now has power to do so.

2. Provisions which remove certain anomalies which existed in respect of the period of service of Members of the Council. The wording of previous Charters might have resulted in some cases of Members of Council having to retire in rotation before completing a full first or second term of eight years. The Charter now provides for every Member of Council to be elected for a full eight years with eligibility for re-election for a second like period.

3. Provisions which make it unnecessary for a ballot to be held for election to the Council on occasions when the number of candidates for election does not exceed the number of vacancies and each of such candidates is a Member of Council retiring in rotation and applying for re-election.

4. Provisions enabling the Council to elect as co-opted Members of Council representatives of branches of the allied specialities who are not diplomates of the College.

5. A provision giving the Council power to extend from fifty to sixty-five the number of Honorary Fellows existing at any one time. The Council has resolved that of this number of sixty-five not more than fifty shall be medical and not more than fifteen lay men or women.

6. Provisions which change the diploma of Fellowship of the Faculty of Anaesthetists to that of Fellowship in the Faculty of Anaesthetists and giving such Fellows, and Fellows in any future Faculty, equal status in the College with Fellows in Dental Surgery.

7. A provision giving the College power to combine with other bodies in instituting and establishing joint Faculties in the College and to grant Fellowships in such Faculties.

8. A provision enabling Fellows of the Royal Australasian College of Surgeons or the Royal College of Physicians and Surgeons of Canada who are in the *bona fide* practice of surgery in England or Wales to apply for election to the Fellowship *ad eundem*.



9. A provision giving the College power to elect up to fifteen Honorary Fellows at any one time in each of the Faculties or joint Faculties of the College.

10. A provision giving the College power to elect, without examination, as an Associate of the College, any duly qualified medical, surgical or dental practitioner. Such Associates will have none of the rights or privileges of Members of the College nor the right to be regarded as Members of the College. The intention is to attach to the College, in some formal way, visiting surgeons from overseas and other appropriate persons who might value such a link with the College and would feel thereby that they had some place in the College.

11. A provision increasing to £125,000 the annual value of "lands, tenements, rents or hereditaments wheresoever situate" which it is lawful for the College to hold and enjoy.

The illustration shows the obverse and reverse sides of the Great Seal which is attached to the Charter. The Seal is embossed in a red plastic material and is a handsome adjunct to the Charter itself.

RESTORATION AND REBUILDING OF THE COLLEGE

IN JANUARY THERE came news which, although not strictly concerned with the rebuilding of the Royal College of Surgeons itself, was of the greatest significance in the scheme for developing the south side of Lincoln's Inn Fields as a medical centre. This news was in fact the formal permit from the London County Council for the erection of a building by the Imperial Cancer Research Fund on the sites of Nos. 44, 45, and 46, Lincoln's Inn Fields (immediately adjacent to the Royal College of Surgeons) and by the College of General Practitioners on the remainder of the site lying to the west and comprising Nos. 47-50.

RESTORATION AND REBUILDING OF THE COLLEGE

To make use of this valuable and attractive site for the buildings of kindred institutions had long been the aim of the College, and as far back as 1947 the appropriate authorities had been approached and given their consent and approval to the erection of new buildings coming forward to a line similar to that of the Nuffield College. Within recent months the College seemed to be faced with a prospect, galling, to say the least of it, of having this earlier forethought disregarded and having to suffer the expense and worry of a public enquiry to decide whether the present buildings might be demolished and replaced by others suitable for institutional purposes. Fortunately, sympathetic counsels have prevailed in high quarters, with the result already announced.

The Imperial Cancer Research Fund will have a ninety-nine-year lease from the College of the sites of Nos. 44 and 45 and is (or very soon will be) the owner of No. 46. The building, in accordance with the conditions laid down by the planning authorities, is to be similar to the Nuffield College in general appearance, although it need not be so in detail: a representation of the Architect's drawing has often appeared in the advertisement pages of the ANNALS. In the main the building will be a laboratory block, replacing the laboratories now situated in No. 48, Lincoln's Inn Fields and the College, and providing a great deal of additional space. It will also be the Fund's headquarters, but will not render the Mill Hill laboratories redundant.

The College of General Practitioners building will harmonise in style with the others, and the Architect's drawing was recently published in *The Times*. The work of building cannot start until the Imperial Cancer Research Fund's building has been finished and one or two questions of outstanding leases have been settled. The building is to be on the sites of Nos. 47, 48 and 49, Lincoln's Inn Fields, and in this case also there will be a long-term building lease. No. 50 is included in the planning permission; although the future use of this site (now subject to a long lease) is yet to be determined. The College of General Practitioners' building will be their general headquarters, including such features as a Conference Hall, Council and Committee Rooms, Offices, Library, and a limited amount of residential accommodation.

It is to be hoped that when this building programme has been completed it will give the south side of Lincoln's Inn Fields a dignified and harmonious "new look," as well as providing buildings in which these important bodies may pursue more effectively than ever their great work for humanity.

OVERSEAS VISITORS TO THE COLLEGE

RECENT OVERSEAS VISITORS to the College have included Mr. D. M. Mitchell of Palmerston, New Zealand, who attended the Monthly Dinner in January, and Mr. E. A. Rowlands of Melbourne, Australia, who attended the Monthly Dinner in February.

JANUARY, 1958, MONTHLY DINNER

THE MONTHLY DINNER on 8th January 1958 had an unusual feature in the appearance of Mr. Joe Davis in the Nuffield College to give a demonstration of Billiards and Snooker on the Billiard Table recently presented to the College by Mr. Caryl Thain. The performance was marvellous to behold and raised in some minds the thought that possibly the super surgeon of the future will give fifteen years to mastering technique and judgment, as do billiards players, not being bothered meantime with theoretical knowledge and emerging at the end the perfect craftsman with corresponding mortality rate.



Left to right (in the foreground): Professor G. J. Cunningham, the President, Professor Sir James Paterson Ross, Mr. Joe Davis and Mr. A. Dickson Wright.

Opposition provided by Professor Cunningham and Sir Victor Negus was dealt with rather ruthlessly, although it was noticed that Sir Victor Negus's score was 50 per cent. better than Professor Cunningham's. In mitigation of Professor Cunningham it was observed that he had only three balls on the table while playing billiards, whereas Sir Victor had as many as twenty-four while playing snooker with the increased possibilities arising therefrom.

Following the billiards and snooker match, a series of trick shots caused great astonishment, the balls being commanded to the almost impossible by the skilled cue of the virtuoso. Mr. Joe Davis has earned our gratitude because he has raised at various snooker exhibitions £10,000 for the Imperial Cancer Research Fund.

A.D.W.

BOOKS ADDED TO THE LIBRARY, OCTOBER-DECEMBER 1957

Surgery:

- COPE. Early diagnosis of the acute abdomen. 11th edition. Author's gift.
EQUEN. Magnetic removal of foreign bodies.
FLAVELL. An introduction to chest surgery.
MOSELEY. The forequarter amputation. Author's gift.
QUENU. Nouvelle pratique chirurgicale illustrée, fasc. 10. Gift of Prof. R. Milnes Walker.
ROB AND SMITH. Operative surgery, vol. 5. Gift of Mr. M. L. Formby (continuation).
TRUMBLE. Collected papers. Gift of Sir Cecil Wakeley.

Anaesthesia

- PROCTOR. Anaesthesia and otolaryngology. Gift of Dr. R. Woolmer.

Anatomy

- CAMPBELL. The respiratory muscles.

Biochemistry and Endocrinology

- DODDS. Biochemical contributions to endocrinology.
GAEBLER (editor). Symposium on enzymes.

Gastroenterology

- ALVAREZ. Introduction to gastroenterology.

Genetics

- GRUNEBERG. Genes in mammalian development.

Haematology

- LAMMERANT. Le volume sanguin des poumons. Gift of Messrs. Christiaens, Brussels.
WHITBY AND BRITTON. Diseases of the blood. 8th edition.

Histology and Cytology

- HAM. Histology. 3rd edition.
HEWER. Textbook of histology. 7th edition.
GIESE. Cell physiology.

Jurisprudence

- GLAISTER. Medical jurisprudence and toxicology. 10th edition.

Pathology

- BARON. Essentials of chemical pathology.
FLOREY. General pathology. 2nd edition.
ROBBINS. Textbook of pathology.

Physiology

- HOYLE. Comparative physiology of nervous control of muscular contraction.
MCLWAIN. Chemotherapy and the central nervous system.

Urology

- HANLEY. Recent advances in urology. Author's gift.

Reference Books

- CAMBRIDGE BIBLIOGRAPHY OF ENGLISH LITERATURE. Supplementary volume.
MORTON. How to use a medical library.
WEISS. Catalogue of ophthalmic instruments. Editor's gift.
WORLD DIRECTORY OF MEDICAL SCHOOLS. 2nd edition.
WORLD MEDICAL PERIODICALS. 2nd edition.

Historic Texts

- ADAIR. Memoirs of Robert Adair. 1790.
COSTE. Lettre sur l'embryogénie. (Early 19th century.) Gift of Miss J. Dobson.
GILL. The CHCl_3 problem, vol. 1. Gift of Mr. Frankis Evans.
MONRO. The anatomy of human bones. 5th edition. 1750.
MOORE (ANN). The fasting woman of Tutbury. 3 pamphlets. 1809-1813.
PAGET (SIR JAMES) Selected essays and addresses. 1902. Gift of Mr. H. C. Edwards.
PAGET (SIR JAMES). Autograph letters to him from famous correspondents, including Darwin, Pasteur, Florence Nightingale, Virchow, etc. Gift of Paget's great-grandson. Mr. A. Thompson.

IN MEMORIAM

History of Medicine

- COHEN, R. A. Catalogue of the dental library of Mr. R. A. Cohen of Warwick. Typescript. Gift.
COPE (editor). Sidelights on the history of medicine. Gift of Sir Zachary Cope.
DIBLE. History of the Pathological Society.
GANDEVIA. Annotated bibliography of the history of medicine in Australia. Gift of Sir Gordon Gordon-Taylor.
JORDAN. Science and the course of history. Gift of Yale University Press.
ROOSEBOOM. Microscopium (History of the microscope). Gift of Messrs. Pfizer.

In Memoriam

MISS HENRIETTA BROWNE

READERS MAY BE interested to know that the Miss Henrietta Browne whose death was announced in the *Manchester Guardian* on 20th January was the youngest sister of Sir George Buckston Browne, F.R.C.S., after whom the Biological Research Station at Downe, Kent, was named. She was in her 101st year. Her father, Dr. Henry Browne, was Physician to the Manchester Royal Infirmary for twenty-five years; and it was in 1891 that he bought a house in Victoria Park, The Gables, where Miss Browne lived for the rest of her long life. In 1887, she took the Mathematical Tripos at Cambridge, was a Senior Optime and the head woman of her year. No degree could be granted to women in those days and when this was altered she was already too old to be able to attend in person; but the degree of M.A. was duly conferred upon her in her absence, the authorities at Newnham arranging a proxy.

J.D.

GWYNNE WILLIAMS, M.D., M.S., F.R.C.S.

WE REGRET TO record that Mr. Gwynne Williams, a former member of the Court of Examiners, died on 3rd February 1958 in University College Hospital, to which he was a consulting surgeon.

Gwynne Williams was born in 1881 at Luton, and proceeded from Bedford Grammar School to University College Hospital, where he had a brilliant career as a student and after his qualification in 1903. He came early under the influence and inspiration of Wilfred Trotter, who set him the highest example in surgery and encouraged his independence of outlook and distrust of dogma. He was appointed assistant surgeon in 1914, surgeon in 1919, and consulting surgeon when he retired in 1946. He had lived at the Hospital throughout the air raids in the war of 1939-45, in charge of the casualty clearing services, and had previously been responsible for modernising the fracture service, with the full support of his surgical colleagues. From 1935 to 1943 he was Dean of the Medical School and Chairman of the Medical Committee.

Gwynne Williams had been a Fellow of this College for fifty-one years, having been admitted on 13th December 1906, and he served on the Court of Examiners from 1926 to 1936. His son Mr. D. Innes Williams is also a Fellow.

W.R.L.F.

PROCEEDINGS OF THE COUNCIL IN FEBRUARY

AT A MEETING of the Council on the 13th February, with Prof. Sir James Paterson Ross, President, in the Chair, Mr. Hugh Reid (Liverpool) and Mr. A. H. M. Siddons (St. George's) were elected and Prof. Victor Lambert (Manchester) was re-elected to the Court of Examiners for a period of three years from 13th February 1958.

The death of Mr. Gwynne Williams, past member of the Court of Examiners, was recorded with deep regret.

The Hallett Prize was awarded to Dr. K. A. Butler, of Westminster Hospital Medical School.

Handcock Prizes were awarded to Miss Shirley A. P. Abell, of King's College Hospital Medical School and to Mr. D. R. Matthes, of West London Hospital Medical School.

Diplomas were granted as follows :

Fellowship (1), Membership (106), Fellowship in Dental Surgery (15), Licence in Dental Surgery (1), Fellowship in the Faculty of Anaesthetists (24).

The following diplomas were granted, jointly with the Royal College of Physicians :

Industrial Health (1), Medical Radiotherapy (1).

The following hospitals were recognised under paragraph 23 of the Fellowship Regulations :

HOSPITALS	POSTS RECOGNISED		
	General (all 6 mths.)	Casualty (all 6 mths.)	Unspecified (all 6 mths.)
CUCKFIELD—Cuckfield Hospital . .	S.H.O.		S.H.O. (Orth.)
BARNSELY—Beckett Hospital . . (Additional)	S.H.O.		S.H.O. (Orth.)
LONDON — Dalston German Hospital .	<i>Temporary recognition until March, 1959</i> R.S.O. (S.H.O.)	Cas. Officer (S.H.O.)	
DAYVHULME — Park Hospital (Additional)		J.H.M.O.	
ENFIELD—Chase Farm Hospital (Redesignation)		S.H.O. upgraded to Regr.	

DIARY FOR MARCH (18th-31st)

Tues. 18	5.00	DR. G. T. ALLEN—Erasmus Wilson Demonstration.*
Wed. 19		Board of Faculty of Anaesthetists.
	4.00	Annual General Meeting of Faculty of Anaesthetists.
		PROF. W. D. M. PATON—Joseph Clover Lecture—Mechanisms of Transmission in the Central Nervous System.*
		D.C.H. Examination begins.
Thurs. 20	3.45	MR. P. A. RING—Arnott Demonstration—The development and growth of long bones.*
	5.00	PROF. R. A. STEPHEN—Hunterian Lecture—Malignant testicular tumours.*
Fri. 21	5.00	Board of Faculty of Dental Surgery.
		Last day for applications for Annual Examinerships.

Mon.	24	5.00	PROF. A. SORSBY—Ophthalmology Lecture—Treatment of ocular palsies.*
Tues.	25	5.00	PROF. J. P. HOPEWELL—Hunterian Lecture—The hazards of uretero-intestinal anastomosis.*
Thurs.	27	5.00	PROF. R. B. WELBOURN—Hunterian Lecture—The surgical aspects of adrenocortical disorder.*
Fri.	28	4.30	Date of Election announced. Sir STEWART DUKE-ELDER, G.C.V.O., F.R.C.S., Lister Oration—The emergence of Vision in the Animal world.
Mon.	31		Final Membership Examination begins.

DIARY FOR APRIL

Fri.	4		GOOD FRIDAY. College closed.
Sat.	5		College closed.
Mon.	7		EASTER MONDAY. College closed.
Tues.	8		Surgical Lectures and Clinical Conferences begin.
		5.15	MR. E. G. MUIR—Carcinoma of the Rectum and Anterior Resection.
		6.30	MR. T. HOLMES SELLORS—Diagnosis and Treatment of Atrial and Septal Defects.
Wed.	9	5.15	MR. F. W. HOLDSWORTH—Traumatic Paraplegia.
		6.30	DR. R. A. SHOOTER—Spread of Infection in Hospitals.
Thurs.	10	5.15	MR. D. N. ROSS—Hypothermia as an Aid to Surgery.
		6.30	MR. RAINSFORD MOWLEM—The Treatment of Lymphoedema.
Fri.	11		Course in Clinical Surgery ends.
Mon.	14	5.15	MR. RODNEY SMITH—Pancreatitis.
		6.30	MR. L. N. PYRAH—Urinary Diversion.
Tues.	15	3.45	DR. R. McP. LIVINGSTON—Arnott Demonstration.—The Human Embryo: the Development of Form.*
		5.15	SIR ARTHUR PORRITT—Non-malignant Conditions of the Breast.
		6.30	MR. RONALD FURLONG—Osteo-arthritis of the Hip.
Wed.	16	5.15	PROF. F. A. R. STAMMERS—Complications of Gastrectomy.
		6.30	SIR HARRY PLATT, Bt.—Congenital Dislocation of the Hip.
		7.30	Monthly Dinner.
Thurs.	17	2.00	Quarterly Council.
		5.00	PROF. A. G. JESSIMAN—Hunterian Lecture—Hypophysectomy in the treatment of breast cancer.*
		6.15	PROF. C. A. WELLS—Prostatic Obstruction.
Fri.	18	5.15	MR. R. GUY PULVERTAFT—Reconstructive Surgery of the Hand.
		6.30	MR. SELWYN TAYLOR—Radioactive Isotopes as an Adjunct to Surgery.
			Last day for nomination of candidates for the Council.
Mon.	21	5.15	MR. C. P. WILSON—Malignant Disease of the Superior Maxilla.
		6.30	SIR CLEMENT PRICE THOMAS—Carcinoma of the Bronchus.
			Last day for nomination of candidates (F.D.S.) for election to the Board of Faculty of Dental Surgery.
Tues.	22	5.00	MR. I. P. TODD—Arris and Gale Lecture. The Physiology of Rectal Sensation and its Relationship to Disease.*
		6.15	MR. RODNEY MAINGOT—Post-operative Strictures of the Bile Ducts.
Wed.	23	5.15	MR. H. J. SEDDON—The Surgery of Poliomyelitis.
		6.30	MR. S. O. AYLETT—Ulcerative Colitis.
Wed.	23		Second L.D.S. Examination begins.
Thurs.	24	5.15	MR. WYLIE McKISOCK—Surgical Treatment of Intracranial Aneurysms.
		6.30	PROF. C. G. ROB—Arterial Occlusion.
			D.M.R.D. Examination (Part II) begins.
Fri.	25	5.15	MR. N. R. BARRETT—Tumours of the Chest Wall.
		6.30	MR. VICTOR RIDDELL—Management of Thyrotoxicosis.
			Surgical Lectures and Clinical Conferences end.
			Last day for applications for Lectureships.
Sat.	26		Dental Lectures and Clinical Conferences begin.
Mon.	28		
Tues.	29	5.00	DR. H. G. H. RICHARDS—Erasmus Wilson Demonstration—Thrombosis and Infarction.*
			Final Fellowship Examination (Ophthalmology and Otolaryngology) begins.

* Not part of courses.



4

ZERO POSITION OF THE GLENO-HUMERAL JOINT: ITS RECOGNITION AND CLINICAL IMPORTANCE

Hunterian Lecture delivered at the Royal College of Surgeons of England
on

10th July 1957

by

A. K. Saha, B.Sc., M.Ch.Orth.(Liverpool), F.R.C.S., F.R.C.S.(E.)
Professor of Surgery, Milratan Sircar Medical College, Calcutta University

INTRODUCTION

THE TIME HAS come to take stock of the accumulated knowledge on shoulder movements.

The gleno-humeral joint is a ball and socket joint, the head of the humerus having a bigger articular surface with a smaller radius and the glenoid a smaller articular surface with a bigger radius. Participation of the accessory joints in shoulder movements have long been recognised (Morris, 1879; Cathcart, 1884 and Lockhart, 1930). Till recently (*vide infra*) the movements at these and the gleno-humeral joints were believed to be phasic and compartmental.

The occurrence of reverse rotations during flexion and abduction (Martin, 1933; Codman, 1934 and McGregor, 1937) led to the concept of locking with rotation as a mechanism to get past the natural barriers. The plane of the scapula, though a changing plane in a strict sense, replaced the coronal plane as the plane of reference (Johnston, 1937). Later still Milch (1938, 1949) described the cone arrangement of muscles when the arm is lifted overhead. In this position the muscles lose all rotatory power and this suggested the technique of reduction of the shoulder dislocation in the overhead vertical position of the arm. Inman, *et al.* (1944) established the pattern of movements of the accessory joints. They are continuous though they occur at varying rates at different phases of elevation. The function of depressors on the head of the humerus were established. They keep the head in contact with the glenoid during elevation.

ANATOMICAL CONSIDERATIONS

The gleno-humeral joint surfaces are not perfectly spherical. Rotundity is near perfection at the central part of the two articular areas. There are individual variations and variations with age, though their exact relation has not been established (Fig. 1). Spherometry has also established three types of joints—Type A: the glenoid has a bigger radius than that of the humerus; Type B: both have more or less the same radii; and Type C: the glenoid has a smaller radius than that of the humerus (Fig. 2). In Type A, the contact of the adjoining articular surfaces is by a small area, in Type B, by a much bigger surface and in Type C, the contact is mainly by the margin of the glenoid labrum and the adjoining articular surface. Impression studies of the contact surfaces with the help of lamp

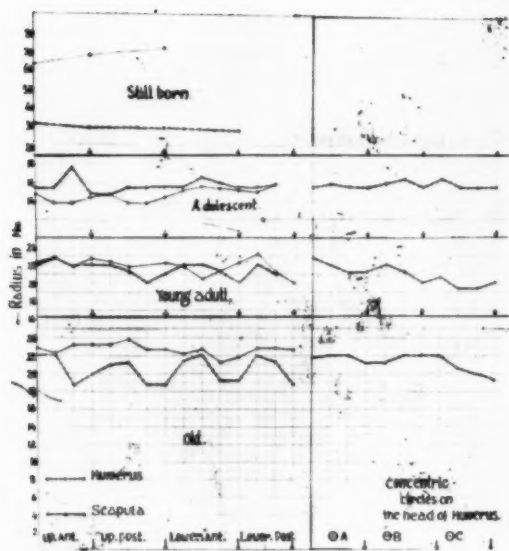


Fig. 1. Graph shows the radii of curvatures of the humeral head and glenoid cavity. Fresh specimens from dead bodies were used. Dotted and continuous lines represent radii of humerus and glenoid respectively. *Left hand* series gives the radii in stillborn mature babies, adolescents, young adults and old, and these were taken in four quadrants. They are seen to be too irregular to be called spherical surfaces. The disparity between the articular surfaces can be seen. Graphs on the *right hand* side represent radii on two concentric bands and a central circle on the heads of the humeri used in the previous determination. The radii are more uniform towards the central part of the articular surface in all than towards the periphery.

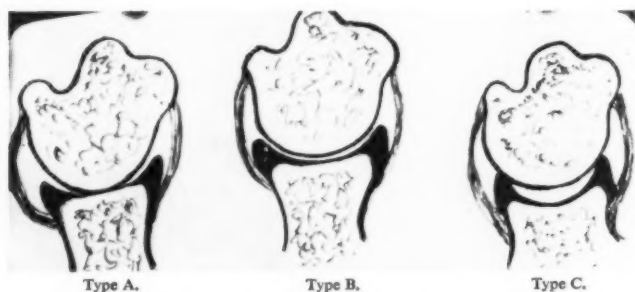


Fig. 2. The three types of joints and their contact surfaces.

black in different positions of elevation have shown three types corresponding with the three types of joints. The contact surfaces do not take uniform impression nor are these identical in different positions of elevation in the same joints. These confirm the irregular nature of the articular surfaces. The contact area migrates in a characteristic way on the humeral articular surface and less so on the glenoid cavity particularly in the Type C joint in the different phases of elevation (Fig. 3). The anatomical axis of the head and neck bears two angles with the axis of the shaft, 16 degs. in the coronal (retrotorsion angle) and about 130 degs. in the sagittal plane (neck-shaft angle). With abduction the contact area is exhausted in the plane of elevation before 90 degs. is reached. How then is the rest of the movement at the gleno-humeral joint carried out? This is possible by rolling or gliding, analogous to dislocation action within physiological range. This movement would be difficult if the head of the humerus was set on the top of the shaft in a "drum stick" fashion as in quadrupeds. In man with the development of erect posture, the upper limb has come to stay vertical and parallel to the body. So he has developed the neck-shaft and the retrotorsion angulations just mentioned. These structural changes have helped him in another way. The rotation of the shaft gives gliding effect at the articular end till the constantly changing mechanical axis approximates to the anatomical axis in the "zero-position" of the gleno-humeral joint (*vide infra*).

Acromion locking during elevation does not take place in any phase of abduction in a healthy joint. The external rotation of the shoulder is necessary even after acromionectomy during abduction.

Shoulder movements

Movements at the gleno-humeral joint may be analysed as follows:

- (i) Movement on a fixed contact point, area or band (hinging). There is no change of mechanical axis.
- (ii) Movements that bring about change of contact point, area of band—this has been referred to as gliding, rolling or physiological dislocation action. There is change of mechanical axis with this type of movement.
- (iii) Movement of rotation—even if it takes place on a circular band contact, pressure would be distributed equally on all points of the contact surface. Here there is no change in mechanical axis.

One or all of these may be necessary to bring about elevation in any direction.

The nature of the "breast-stroke" movement at the gleno-humeral joint has never been dealt with analytically. "Breast-stroke" movement is a combination of gliding (rolling) and some amount of hinging movements. Its range diminishes with the elevation of the arm.

Rotation of the arm and rotation at the gleno-humeral joints are not identical till the mechanical axis corresponds with the anatomical axis of the shaft of the humerus. It has been seen that rotation of the arm which is

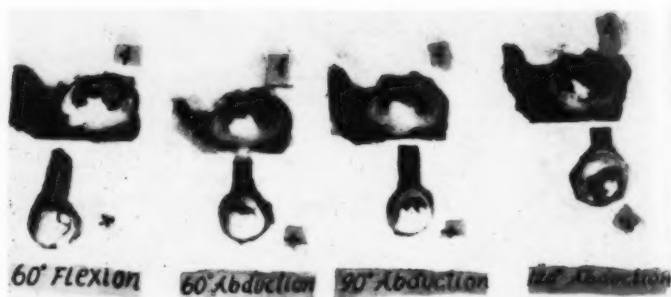


Fig. 3. Lamp black contact impression photographs of the glenoid and humerus at 60 degs. of flexion and abduction, 90 degs. of abduction and 120 degs. of abduction in a typical Type C joint. These irregular circular contact bands hardly migrate in the glenoid with different elevations though they do so on the head of the humerus.

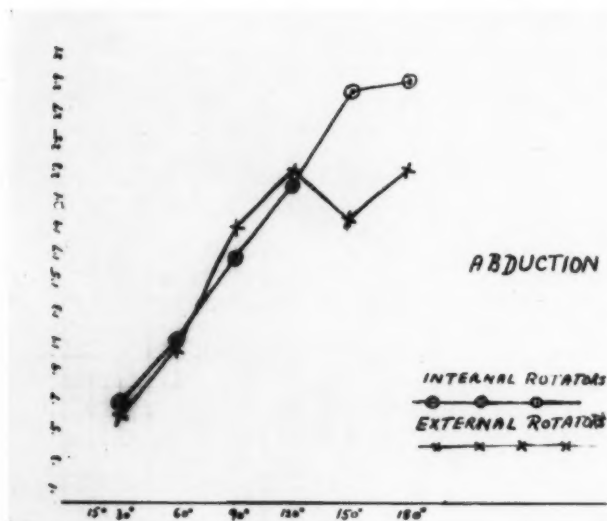


Fig. 4. Sum of action potential of anatomically recognised internal and external rotators are plotted at different phases of abduction. Continuous line with crosses represents summated action potential of external, and continuous line with circles, that of internal rotators.

ZERO POSITION OF THE GLENO-HUMERAL JOINT

equivalent to gliding at the gleno-humeral joint steadily diminishes with the raising of the limb. Rotation at the gleno-humeral joint is equivalent to circumduction with vertical position of the extremity. Its range also shows steady diminution with lifting of the limb.

Why the above three movements diminish as the arm is raised is understandable when it is seen that the contact area change-over brings about alteration in the mechanical axis. This, when the movements are "Zero" corresponds most closely to the anatomical axis of the shaft. In this position most of the rotatory power of the muscles is lost.

Muscle power

Action potentials and frequency discharges recorded during abduction and flexion by eight channel electromyography have shown that besides the prime movers acting in a particular direction, other muscles also show activity to varying degrees. This accessory power is essential—(a) to fix the gleno-humeral joint, (b) help gliding and thus bring about change of contact surface, and (c) move the accessory joints. For deeper muscles coaxial needle electrodes were used. Unsuspected muscles like the latissimus dorsi and the subclavius are seen to come into play during elevation.

During abduction, the supraspinatus and the deltoid are known to be prime movers. The remaining six muscles, infra-spinatus, teres minor, teres major, subscapularis, pectoralis major (sternal) and latissimus dorsi also show variable amount of contraction starting at about 30 degs. (Fig. 4). The power of the internal rotators balances the power of the external rotators so that the algebraic sum of their power does not alter the rotation state of the humeral head up to about 60 degs. elevation. The power till then is utilized only for fixation of the head against the glenoid. Above 60 degs. the external rotators gain more power which is utilized for gliding purposes. The main internal rotator, the subscapularis, has towards the end of elevation only gliding and fixation action. Above 120 degs. the power of the internal rotators again exceeds that of the external rotators.

In flexion, adjustment of the shoulder girdle takes place at a slightly earlier phase to make elevation at the gleno-humeral joint easy (Fig. 5). From the very onset the internal rotators are more powerful than the external rotators and at the peak (120 degs.) are twice as powerful as the external rotators. The events are explained on the same lines as in abduction. The gleno-humeral articular surfaces change by rotation of the shaft in the initial and end stages of flexion movement.

In movements at the accessory joints we notice that the subclavius plays a major role both in abduction and flexion. The subclavius rotates the clavicle-crankshaft in an anti-clockwise direction (looked at from its outer end) and indirectly adjusts the scapula to bring about the desired elevation. Electromyographic studies show that the movement just mentioned takes place at an earlier phase in flexion (Fig. 6). The rotation

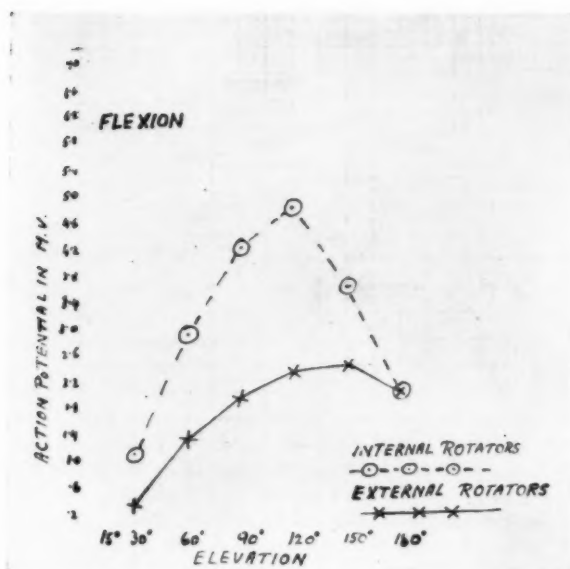


Fig. 5. Sum of action potential of anatomically recognised internal and external rotators are plotted at different phases of flexion. Continuous line, with crosses represents summated action potential of external, and dotted line with circles, that of internal rotators.

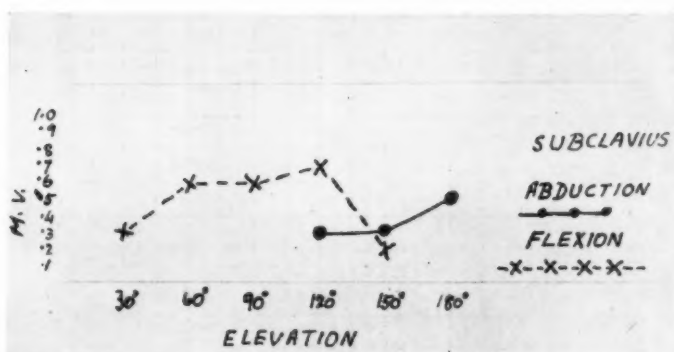


Fig. 6. The diagram represents the action potential in millivolts of subclavius at different phases of abduction and flexion. Dotted line with crosses represents action potential during flexion and continuous line, action potential during abduction.

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of the clavicle crankshaft is maximal between 150 degs. and 180 degs. during abduction. During flexion rotation of the clavicle starts at 30 degs. of elevation and is maximal at an earlier phase.

Scapulo-humeral rhythm is an essential component of the sequence of events taking place during elevation of the shoulder. So accurate is the balance and adjustment that even slightest disturbance by way of spasm of any particular muscle, pain from any cause, limitation of movement and disturbance in the mechanism of joint components would upset the scapulo-humeral rhythm.

"Zero-position" of the gleno-humeral joint

The position during elevation in coronal or sagittal plane, in fact in any plane where there is no further rotation, no active gliding of the joint surfaces and circumduction; where the mechanical axis corresponds to the anatomical axis of the shaft; where gliding, rotation and "breast-stroke" movements become identical is known as "zero-position." In this position the humerus is neither internally nor externally rotated. The humerus is elevated to about 165 degs. with individual variations and is in the newly acquired scapular plane. The humeral shaft axis roughly is in alignment with the scapular spine in this position. This is the relative position of scapula and humerus which is seen in fast-moving quadrupeds to give stability to the joint. This has brought structural change, the articular surface sits square on the top of the shaft like a "drum-stick."

In the unimpacted fracture of the surgical neck it has been shown that, if released from the influences of the lower by elevation in any plane, the upper fragment assumes the "zero-position."

Bearing of the anatomical observations on the aetiology of the recurrent dislocation of the shoulder. Alternative method of treatment on the basis of the concept.

In the Type C joint the humeral articular surface is not in contact with the depth of that of the glenoid cavity. The circular-band-contact in this joint is effected mostly by the glenoid labrum with much less excursion and change of contact band in glenoid cavity than in the other two types. So the physiological dislocation action, bringing about change of contact band on humeral articular surface, will, in these cases, throw maximum pressure on some portion of the glenoid labrum depending on the direction of the motion. If the power of the subscapularis which brings about this in the terminal phases of abduction is insufficient due to various causes including incoordination from sudden contraction of the prime movers and other muscles it may throw extra burden on the anterior and/or inferior part of the labrum thus causing it to be detached from its bony attachment. It is distinct from other types of dislocation where the tear is in the capsule and is capable of healing, but in this type of subluxation, the detached rim cannot heal by itself by reattachment.

To my mind recent views on the pathology of the recurrent dislocation

cannot effectively explain (a) the groove on the humeral head and (b) in some cases splitting and attenuation of the glenoid labrum at the site of detachment analogous to the finding of a medial meniscus tear.

With this untreated and detached glenoid labrum, further unguarded elevation with external rotation may result in forward migration of the head of the humerus when actually there should be a backward rolling.

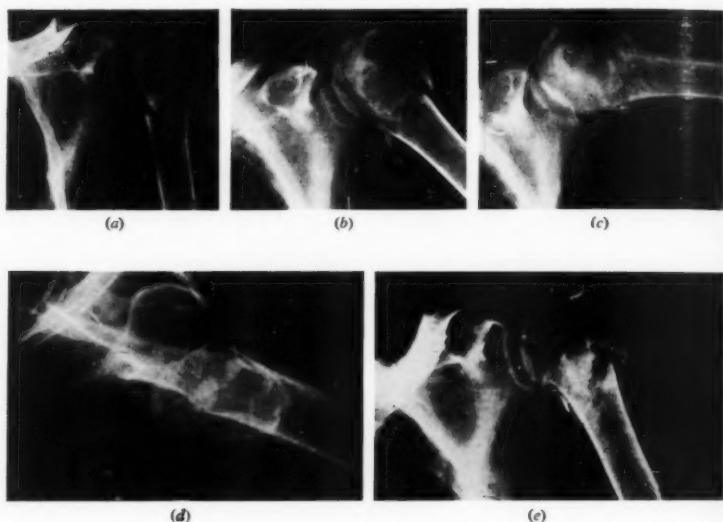


Fig. 7.

- (a) Antero-posterior skiagram of the shoulder shows unimpacted fracture of the surgical neck. The upper fragment is internally rotated.
- (b) De-rotation of the proximal fragment with 45 degs. of abduction is seen. Outline of the head is visible as an area medial to the tuberosity.
- (c) Further elevation has brought in relief the greater part of the head.
- (d) Elevation to the zero-position has brought the whole of the head outline as would be seen in an ordinary antero-posterior skiagram of the shoulder.
- (e) Skiagram shows impaction after reduction in the "zero-position." There is some comminution of the fragments during the impaction.

Repeated many times, the subscapularis further elongates and its active rolling action progressively deteriorates, resulting in more frequent recurrences. The feeling of something giving way and locking in that position is due to muscle spasm from riding of the head on the edge of the bony glenoid (subluxation). The characteristic groove on the head, if present, makes slipping easier.

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The main principles on which treatment of this condition would be based are thus :

- (i) Actual repair of the lesion, i.e., reattachment of the detached labrum to the bony glenoid.
- (ii) Shortening and "double breasting" of the subscapularis to increase its power.
- (iii) Block or check operations, either by bone, tendon or fascia ; and
- (iv) Development of extra power to aid the physiological dislocation action of the subscapularis by muscle transplantation.

On the basis of this last principle a new operative procedure was developed for the cure of the recurrent dislocation of the shoulder. The method consists of transplantation of the insertion of the latissimus dorsi on the posterior aspect of the greater tuberosity so that during abduction the muscle will assist the subscapularis to draw the humeral head backwards and prevent its forward slipping. This muscle was chosen in view of its synergistic action, checked electromyographically during the later stages of abduction of the arm overhead.

The operation was performed by us on a cured epileptic with a bilateral recurrent dislocation where the right side had been treated by the Bankart procedure by one of our colleagues one year before.

The patient last seen about one year from the date of operation has full use of the limb and there has been no recurrence. The operation has been tried only in a single case, so it is too early to pass any definite opinion but the result suggests that it is worth trying in other cases of recurrent dislocation of the shoulder.

Clinical application of "zero-position" in the treatment of dislocation of the shoulder

It is suggested that in treating dislocation of the head of the humerus, the detrimental effect of the rotators, chiefly of the subscapularis, can be effectively eliminated when the limb is brought into the "zero-position." A single force exerted along the axis of the humerus when the limb is in "zero-position" can thus be made to oppose the combined action of all the musculature in spasm.

Method

The patient lies on the table supine, and the surgeon takes his position at the head end and on the side of the dislocation. Usually an anaesthetic is not necessary except in cases of an old dislocation or a neurotic individual. The surgeon gently abducts the arm to bring it in the "zero-position" i.e., 165 degs. overhead and 45 degs. in front of the coronal plane with the medial epicondyle pointing forwards and medially. Slight traction in this direction suffices to reduce the dislocation in recent cases. In older cases an assistant fixes the patient by putting both his hands round the



Fig. 8. It shows the method of fixed traction on side bars incorporated in a plastic jacket in the zero-position.

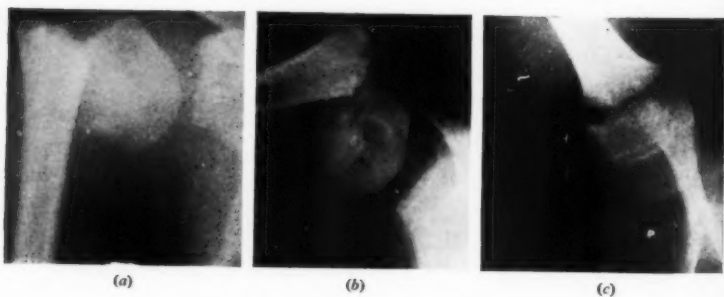


Fig. 9

- (a) Epiphyseal separation in an antero-posterior view.
- (b) Elevation of the distal segment derotates the proximal fragment.
- (c) The typical cap-appearance of the proximal segment appears in the "zero-position." The fracture is completely reduced with traction.

waist. As the surgeon exerts sustained traction, the head goes back to its original position, pushed by the thumb if necessary. An associated fracture of the greater tuberosity, if present, falls into place during this manoeuvre.

After the dislocation is reduced, early motion is encouraged in all directions except in abduction in an uncomplicated case. To check abduction the patient is provided with a figure of eight bandage round the affected arm and the trunk which acts as a "check" ligament. Every third or fourth day greater degree of abduction is permitted by increasing the length of this "check" ligament. After twenty-one days from the date of reduction the sling is taken off and all movements are allowed.

To give full range of mobility, exercises such as swinging the arm at the shoulder or wall climbing exercises are prescribed and within fifteen days the patient gets back the full use of the injured limb.

Unimpacted fracture of the surgical neck of the humerus: displacement of the proximal fragment

Difference of opinion exists regarding the displacement of the upper fragment. The fragment is abducted, slightly flexed and rotated. The rotational displacement is generally believed to be fully external but according to a few it is moderately externally rotated and others internally rotated. With the hanging position of the upper extremity, the fragment is fully internally rotated if it is free from the influence of the distal fragment. The fully internally rotated position of the proximal fragment is proved by comparing it with the identical antero-posterior radiograph of a 45 degs. abducted and internally rotated normal shoulder. In both, the greater tuberosity hides most of the head of the humerus. Secondly, in a true lateral view of the gleno-humeral joint, the radiograph of the upper fragment is a replica of its antero-posterior view with the greater tuberosity pointing towards the sternum. The curve of the head is directed towards the vertebral column and the greater tuberosity towards the sternum. This is true for epiphyseal separation and upper third fracture.

The displacements of the proximal fragment are dependent on the position of the limb. As the distal segment of the limb is raised the abduction displacement steadily increases till it assumes the "zero-position." This new displacement may appropriately be termed absolute abduction.

It is further seen that while changing to the absolute position, the proximal fragment which in its initial position was fully internally rotated, gradually derotates, i.e., rotates laterally and in the final position it is neither internally nor externally rotated (Fig. 7 a, b, c, d).

In the treatment of unimpacted fracture of the neck of the humerus closed reduction is always preferred to the various open methods. Frankau's (1933) method has not proved satisfactory. Perfect anatomical alignment with elimination of rotation deformity is only possible with the help of the "zero-position."

Method of reduction

Under light general anaesthesia the arm is lifted so as to allow the proximal fragment to assume the absolute position, i.e., "zero-position." In this position the fragment is neither rotated internally nor externally. The distal humeral segment is now adjusted to perfect alignment by comparing the direction of the medial epicondyle to that of the sound side when the latter is lifted to the same position. Alignment thus being

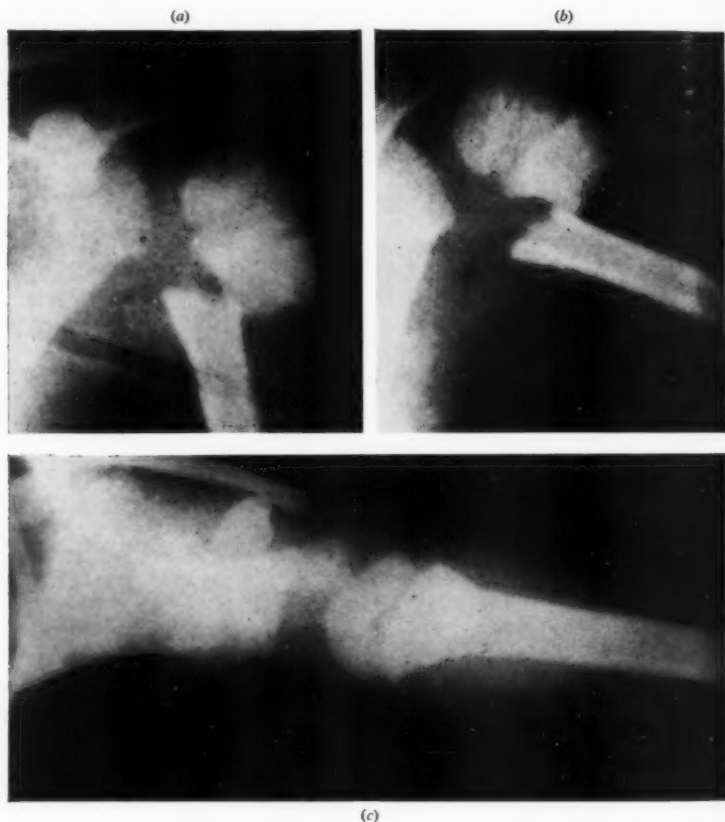


Fig. 10

- (a) Upper fourth fracture of the humeral shaft to show the displacement. The typical appearance of the metaphysis is lost.
- (b) Gradual elevation brings in view the appearance of the metaphysis with derotation of the proximal fragment.
- (c) Elevation in the "zero-position" eliminates the rotation and restores alignment which is maintained by traction.

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achieved, apposition is obtained by firm traction of the limb till the ends hitch against each other. In the majority of instances, especially elderly persons in whom the fracture is common, this end to end apposition may be maintained by impaction by firm compressive force. The arm is then brought down and tested for the stability of impaction (Fig. 7e).

In all our cases possible future disimpaction was prevented by a three-inch overlapping adhesive strapping between the flexed elbow and the top of the shoulder. Cases where there is some comminution are not stable; reduction and fixation is obtained by fixed skin traction over specially constructed iron side bars with a cross loop incorporated in a plaster jacket. A preliminary plaster jacket is applied with a cross bar over the affected shoulder. Specially constructed side bars with a cross loop at the distal ends are incorporated in the plaster. Fixed skin traction is applied with the shoulder in the "zero-position" (Fig. 8). Some of our cases were given mobile skin traction with the help of a Balkan frame and/or Thomas' arm splint. This is especially necessary for very well built individuals. After six to eight weeks of fixation, the movements are allowed till full function is obtained.

Upper humeral epiphyseal separation and fracture of the upper fourth of the shaft of the humerus

In the upper humeral epiphyseal separation, the internal rotation deformity of the upper fragment is not so well demonstrated owing to the poor development of the tuberosity region. The normal upper humeral epiphysis sits like a beret on the proximal diaphyseal end in the antero-posterior view. The presence of rotation deformity masks this appearance. When the rotation deformity is eliminated in the "zero-position" this picture reappears. With alignment of the fragments in this position, slight or moderate traction brings about perfect apposition (Fig. 9 a, b, and c).

Maintenance of reduction has not been possible in our series of cases by impaction. The limb has to be kept under traction for a period of three weeks by one of the methods outlined above till clinical union is obtained. The subsequent management is on the same lines as unimpacted fracture of the surgical neck.

Upper fourth fracture of the humeral shaft

In the upper fourth shaft fracture the displacements are similar. Reduction and fixation are on the same lines. The period of fixation till clinical union is a little longer and varies from four to six weeks (Fig. 10 a, b and c).

CONCLUSION

The present day concept of the mechanism of the shoulder joint has been outlined. Anatomical peculiarities have been shown to explain the

aetiology of recurrent dislocations and a new line of treatment has been advocated.

The "zero-position" has been defined and its clinical use in the treatment of dislocations, unimpacted abduction fractures of the surgical neck, epiphyseal separations and upper fourth shaft fractures has been described.

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THE FOLLOWING GENEROUS donations have been received during the last month :

£10,000 The Simon Marks Charitable Trust (first of seven equal annual instalments).

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THE TREATMENT OF PROSTATIC CANCER

Lecture delivered at the Royal College of Surgeons of England

on

10th April 1957

by

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CANCER OF THE PROSTATE is a disease which occurs with increasing frequency as age advances (Table I) and has nowadays become the commonest malignant condition affecting the uro-genital tract. The process usually originates in the outer zone of the prostate and not infrequently co-exists with some degree of benign enlargement of the inner group of glands. The latter may, in fact, sometimes obscure the diagnosis or act as a contributory cause of local urinary symptoms.

Detailed histological studies of the prostate reveal an incidence of malignant foci far in excess of that of the manifest disease. This finding, taken in conjunction with the knowledge that some cases survive for long periods without treatment, suggests that the disease may exhibit a wide range of activity.

While post mortem records indicate that small foci may sometimes remain in harmless symbiosis with the host for indefinite periods the converse is also often true. Early discrete nodules which appear clinically to be confined within the gland may already be associated with perineural lymphatic extension to the surrounding tissues and even with distant metastasis.

The disease in its more active form kills either by a combination of the effects of urinary obstruction and sepsis, or by the debilitating consequences of widespread dissemination. In uncontrolled cases the later stages may be marked by distressing urinary symptoms and intolerable bone pains which produce a degree of discomfort seldom equalled in other malignant conditions.

Owing to the age incidence of prostatic cancer, however, many of those affected will already have a reduced expectation of life on account of the normal hazards of intercurrent disease. A proportion will, therefore, fail to survive the span of treatment even though cancerous activity is thereby controlled or eliminated.

It is against this background that any critical review of individual methods of treatment has to be made; bearing in mind also that certain measures may be complementary and that combined therapy is often advisable. Before considering the various methods, however, it is important to stress two factors which seem fundamental to their applicability. These are respectively "early diagnosis" and "evidence of activity."

As in other forms of cancer early diagnosis is pre-requisite to the cure of the disease since this objective can at present only be realised by surgical eradication while the growth remains localised. On the other hand, the histological studies already referred to suggest such wide variation in the range of malignant activity that it may be questionable

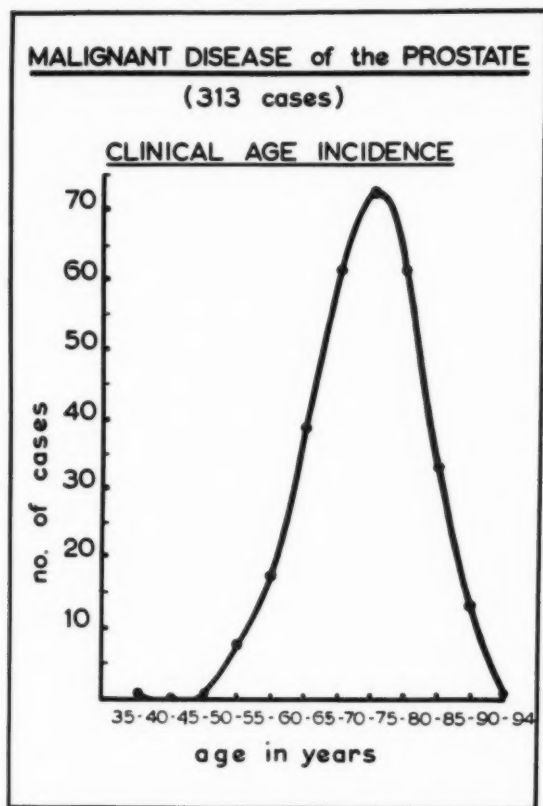


Table I. Clinical age incidence in a personal series of 313 consecutive cases of prostatic cancer. The apparent decline after the age of seventy-five is accounted for by the normal mortality rate from other causes.

whether elimination of the process is always a necessary aim. Furthermore when it is remembered that a substantial proportion of prostatic cancers appear to be dependent, at least temporarily, on endocrine influences which we are partly able to control, the problem becomes more complicated.

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In theory, therefore, the applicability of treatment should depend on the stage of the disease at the time of diagnosis, the degree of activity of the individual growth and its susceptibility to hormonal control. All these factors may be undetermined at the outset and the overall merit of any particular form of therapy can only be gauged on the results achieved in a large series of cases. In this respect, in view of the advanced age of many of the patients it seems desirable that importance should be attached to symptomatic relief as well as to the period of survival and that due regard should also be paid to any unfavourable complications of treatment.

Some guidance may be afforded by the retrospective review of a personal series of 313 consecutive cases of prostatic malignancy (Table II). This group, though smaller than some collected series, has the merit of having been under the supervision of a single observer and being studied throughout with a view to subsequent analysis. No less than 260 cases (84 per cent.) were confirmed by microscopy and the most stringent precautions were taken to exclude any doubtful cases in the remainder.

TABLE II
MALIGNANT DISEASE OF THE PROSTATE
(Personal series 1939-56)

Total number of cases	313
Histologically or Cytologically proven (excluding two cases of sarcoma) 260 ..	(84%)
Basis for diagnosis in remainder :	
Clinical only	27
Clinical and radiological	14
Clinical radiological and serological	5
Clinical and serological	3
Radiological only	2

A majority (241 cases) presented with well developed symptoms of urinary disease, fifty-seven cases had initial metastatic symptoms, twelve cases were detected during the investigation of other disease, and in three the mode of onset was not recorded (Table III).

TABLE III
MALIGNANT DISEASE OF THE PROSTATE
(313 cases)

<i>Initial Clinical Assessment</i>							
Presenting symptoms :							
Local .. .. .	..	..	..	..	..	..	241
Metastatic .. .. .	..	..	..	..	..	..	(—9 combination)
Others .. .. .	..	..	..	..	..	..	57
Not stated .. .. .	..	..	..	..	..	..	12
							3

The main presenting symptom in each case is analysed in Table IV which also gives an initial clinical assessment of the primary lesion in those cases suffering from urinary disorder. From this it will be seen that well over 70 per cent. had an extensive primary lesion at the outset and only 5 per cent. presented with a discrete local nodule. Of the remainder, some were confirmed by accessory methods of investigation and others by microscopy following prostatic resection or enucleation. It is interesting to note that when previously unsuspected cancer was

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brought to light by enucleation the subsequent prognosis was generally satisfactory.

TABLE IV
MALIGNANT DISEASE OF THE PROSTATE
(313 cases)
Presenting Symptoms
Local: 241 cases

Symptom	No. of cases	Initial assessment on rectal examination		
		Benign	General induration	Isolated hard nodule
Frequency of micturition	104	18	81	5
Difficulty with micturition	74	17	56	1
Acute retention	37	8	25	4
Haematuria	20	4 (1 normal-sarcoma)	13	2
Painful micturition	3			
Incontinence	3			

Distant: 57 cases

Symptom	No. of cases	X-ray findings on initial examination			
		Pelvis +ve	L-spine +ve	Spine & pelvis +ve	No mets.
Backache or sciatica ..	39	4	5	22	8
Anaemia	5	0	1	0	4
Distant metastases	13				
Others				12	
Not stated				3	

Of those presenting with metastatic symptoms approximately half showed radiological evidence of secondary spread at the outset.

TABLE V
MALIGNANT DISEASE OF THE PROSTATE
(313 cases)
Initial Clinical Assessment

Presenting signs:				
Local induration of Prostate	..	..	237	
Distant metastases	..	..	76	

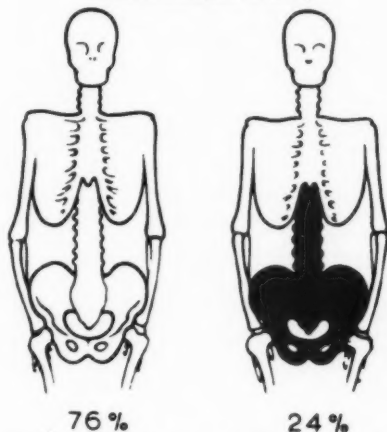
Turning now to the initial signs on clinical and radiological examination (Table V) it will be noted that a number of patients complaining primarily of metastatic symptoms showed unequivocal evidence of growth at the primary site. Conversely a proportion of those suffering predominantly

THE TREATMENT OF PROSTATIC CANCER

from urinary symptoms were found to have radiological metastases. Analysed from this aspect 237 cases (75 per cent.) showed clinical involvement at the primary site initially, while the remainder had clinical or radiological evidence of dissemination.

Radiological examination at the first attendance confirmed the presence of metastases in approximately a quarter of all cases (Table VI).

TABLE VI
MALIGNANT DISEASE OF THE PROSTATE
(313 cases)
Initial Radiological Findings



13 non-metastatic cases were recorded as showing evidence of Paget's disease at repeated examination.

Initial estimation of the serum acid phosphatase, using the King Armstrong method with formalin inactivation, supported the view that this test is mainly of confirmatory value (Table VII). Low levels were encountered in ninety-five cases (of which twelve showed bone metastases), intermediate levels in sixty-seven cases (of which twenty-one had

TABLE VII
MALIGNANT DISEASE OF THE PROSTATE
(313 cases)
Initial serum acid phosphatase levels

S.A.P. level	No. of cases	Metastases in spine and/or pelvis	Paget's Disease	No mets. or Paget's
0-1.9 units	95	12	7	76
2-4.9 units	67	21	3	43
> 5 units	67	34	1	32
Not estimated ..	84	9	2	73

metastases), and high levels in sixty-seven (of which thirty-four showed secondary bone involvement). The reciprocal ratio shown by cases in which Paget's disease was detected is interesting as possibly indicative of a hormonal basis for this condition.

Recently the routine methods of diagnosis have been supplemented by cytological examination of the prostatic secretion (Table VIII). Twenty-three cases were confirmed in this manner although initially only seventeen were regarded as clinically malignant at the primary site. All cases have since shown additional evidence of the disease even though the prostate in two instances remains palpably benign.

TABLE VIII
MALIGNANT DISEASE OF THE PROSTATE
(313 cases)

	Cases
Diagnosis confirmed by cytological examination..	23
Initial clinical assessment:	
Malignant	17
Doubtful	2
	(Isolated nodule)
Benign	4
Two "benign" cases became clinically malignant later.	

From the foregoing review certain facts emerge regarding the stage and, to a lesser extent, the activity of the disease commonly found at the time of diagnosis. It is unfortunate that an overwhelming majority of cases present with extensive induration at the primary site or positive evidence of metastasis. With regard to the remainder a small number may be found fortuitously and it seems clear that their potential malignant activity is often a matter of doubt.

With these facts in mind it is now possible to consider the applicability of available methods of treatment as follows:

TABLE IX
TREATMENT OF PROSTATIC CANCER

1. Palliative medical treatment
2. Relief of urinary obstruction:
 - Catheterization
 - Urethral dilatation
 - Per-urethral resection
3. Radical prostatectomy
4. Suppression of neoplastic activity:
 - Radiotherapy
 - X-rays
 - Radium
 - Isotopes
 - Endocrine control
 - Oestrogen therapy
 - Castration
 - Irradiation of testes
 - Adrenalectomy
 - Irradiation of hypophysis
 - Hypophysectomy

Simple palliative treatment comprising the relief of metastatic pain by analgesics or the temporary relief of anaemia by iron therapy or transfusion is merely applicable to the advanced stages of the

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disease and has no direct effect on the growth process. In the same way urinary symptoms can often be alleviated to some extent with antiseptics and antibiotics but supplementary surgical treatment or hormone therapy will be needed to deal with any predisposing obstruction.

Palliative surgery undertaken with the object of relieving urinary obstruction has a frequent application in cases unresponsive to endocrines or where the effect of the latter is slow or incomplete. The consistency of the cancerous prostate is often such that a more lasting effect is produced by simple urethral dilatation than in the case of benign hypertrophy. When combined with endocrine therapy a sufficient relief of obstruction can frequently be achieved by this means alone. Where further relief is required perurethral prostatic resection is to be preferred to open cystotomy drainage unless heavy urinary infection is present. This has the additional merit of furnishing material for histological study and can be repeated as necessary if obstruction recurs. In a few cases where benign hypertrophy coexists and is thought to be largely responsible for the urinary symptoms palliative prostatectomy may be indicated.

Although perurethral resection or biopsy was carried out in 143 of the 313 patients, and repeated in twenty-five instances, there was no evidence that this procedure ever provoked dissemination of the disease.

Radical surgery. Although radical surgery at present remains the only treatment with a prospect of cure its limitations will be obvious from the foregoing review. The proportion of suitable cases will depend both on the circumstances of diagnosis and on the criteria of operability imposed by individual surgeons. In health-conscious communities, where routine examinations are frequently performed, the opportunities for detecting early operable growths by rectal palpation will be correspondingly increased. When, however, investigation is only undertaken after the onset of positive urinary symptoms the malignant process will in many cases have already extended beyond the operative field.

These considerations in part account for the disparity between the operability rates reported from certain clinics in Great Britain and the United States.

A decision whether or not to operate may further be influenced by post-mortem evidence that discrete primary growths are sometimes associated with microscopic extension or concealed metastases. This in itself, however, raises no serious obstacle as any residual disease may still be treated by other methods. Of more importance is the fact that histological confirmation of cancer at preliminary biopsy does not necessarily afford any index of malignant activity nor of endocrine dependence. The high post-mortem incidence of occult cancer suggests that many growths pursue a relatively benign course and if these could be distinguished during life and controlled by hormones there would seem little indication for subjecting the host to the possible hazards and complications of radical surgery.

Taking the view, however, that only surgery can provide a cure and that endocrine control is often transitory it would seem that radical surgery plays a prophylactic and therapeutic role commensurate with the malignant importance of the small proportion of cases within its scope.

Methods of growth suppression include various forms of radiotherapy and endocrine control.

Radiotherapy suffers from the basic disadvantage that most prostatic cancers are relatively resistant and the delivery of an adequate dose to destroy the tumour almost inevitably leads to irritation and damage to the surrounding structures. This effect may be minimised by supervoltage therapy or by the direct injection of isotopes, but the scope of the method is severely limited to the site of its application. Furthermore, radioactive material inoculated into the prostatic tumour may not long remain there and a considerable proportion subsequently migrates to the liver and elsewhere. The future of the method probably lies in the discovery of an isotope which is selectively taken up by the prostatic epithelium and will thus be able to exert its effect in suitable concentration.

Endocrine control therapy. Following the experimental work of Huggins (1941) increasing experience has indicated that a high proportion of malignant prostatic growths are susceptible to endocrine influences. Based on the assumption that cancerous activity is dependent on androgenic stimulation various methods have been put forward to reduce or eliminate production of the hormone. Among the simpler of these are castration and irradiation of the testes. The former is effective in removing the main source of androgen production but the latter cannot be relied upon to induce a similar effect.

Alternatively synthetic oestrogens may be administered by mouth with the intention of depressing the production of pituitary gonadotrophin and thus indirectly reducing androgen elaboration by the gonads. A voluminous literature testifies to the value of both castration and oestrogen therapy in promoting symptomatic relief and prolonging survival, but some difference of opinion still exists on the relative importance of the two methods. Castration, while implying a small if unpalatable operation, eliminates the main depôt of androgen production but has no effect on extra-gonadal sources. Oestrogens, on the other hand, when given in sufficient doses, adequately suppress the testicular androgens, possibly influence extra-gonadal production and may also exert a direct cytotoxic

TABLE X
MALIGNANT DISEASE OF THE PROSTATE (1939-56)
(313 cases)

<i>Endocrine control therapy</i>			
No. of cases ALIVE	81
No. of cases DEAD	175
No treatment—all dead within 3 yrs.			57
			<u>313</u>

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effect on the growth. At the same time they give rise to certain side effects which, while often embarrassing, are seldom of serious significance.

In estimating the relative merits of the two methods it seems probable that the *dosage* of oestrogens is a matter of importance. While some cases do well on small amounts it has been suggested from biochemical evidence that a dose of 30 mg. stilboestrol a day is tantamount to pharmacological castration. Clinical and histological evidence also indicates that a further measure of control may sometimes be obtained by using greater amounts in cases failing to respond or showing relapse on small doses. In the present series, since 1942, oestrogen therapy has been used in preference to castration (in 256 cases) (Table X) and the dosage steadily increased at intervals from 5 mg. daily in the earlier cases up to a routine dose of 100 mg. a day which has now been employed for some years. The

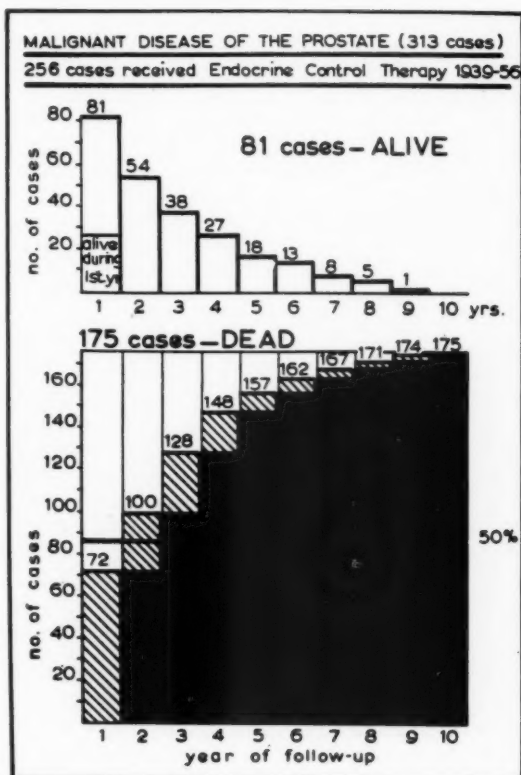


Table XI.

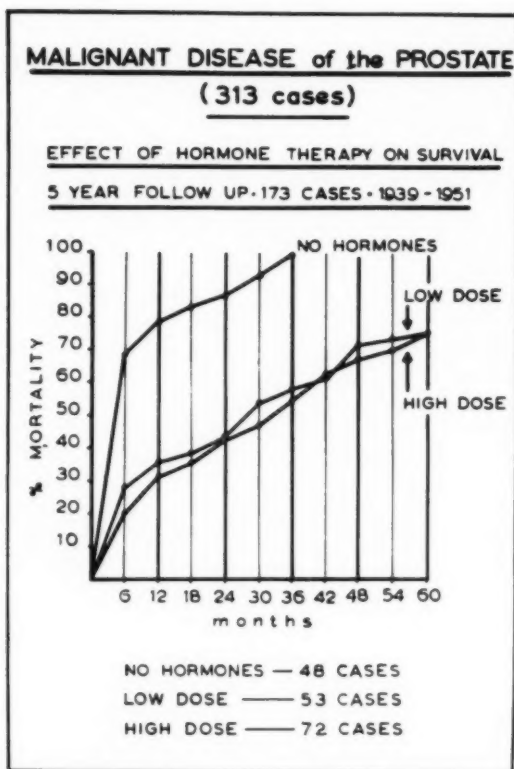


Table XII.

tolerance of such large doses has been found to differ in little degree from that of smaller amounts and the incidence of side effects has been no more marked nor frequent. It has been usual for all cases to receive oestrogens from the time of diagnosis irrespective of any ancillary surgical measures needed to relieve urinary obstruction.

The overall response to treatment is indicated in graphic form in Table XI which shows the survival periods of eighty-one living cases and the annual mortality rate of those which have died (175 cases). It is inevitable in an unselected series that a number have first been seen when already moribund and have consequently failed to survive the first year of treatment.

From these cases three groups have been compiled, all of which received comparable treatment in other respects but differed in regard to hormone dosage. Taking those cases which were treated up to 1951 so as to permit

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a full five-year follow up, 173 patients were selected for further review. These cases have been placed in three groups according to the hormone dosage employed. The first group consisting of forty-eight patients (mostly seen before 1942) received no hormones. An intermediate group of fifty-three patients received up to 10 mg. stilboestrol or its equivalent a day. (In this connection equal doses of dienoestrol have been included despite the supposedly greater pharmacological potency of this preparation.) Finally a third group of seventy-two patients received doses of oestrogens varying between 30 and 100 mg. a day. No clinical selection was made in any of the groups and each includes a proportion of patients with very advanced disease when first seen.

From Table XII it will be noted firstly that the employment of oestrogens exerts a significant effect on the chances of survival and, secondly, that this effect is slightly more marked with higher dosage. During the last five years (1952-56) a majority of patients have been maintained on 100 mg. stilboestrol a day and a general clinical impression remains that the trend has been sustained.

Small numbers of patients have also been treated with TACE and more recently with intravenous Honvan (diethyl stilboestrol diphosphate).

With regard to the former a clinical trial in twelve patients failed to substantiate the claim that the preparation is less likely to induce side effects. Mammary changes were observed with equal frequency as when stilboestrol was used and there was no notable difference in the clinical response. Intravenous administration on Honvan, however, in daily doses of 500 mg. for periods of up to ten days occasionally resulted in dramatic improvement, particularly in promoting the rapid relief of urinary obstruction and benefiting cases showing relapse during routine stilboestrol therapy. Only thirteen cases have so far been treated in this manner but the clinical impression has been favourable.

While symptomatic relief has been achieved in a high proportion of cases receiving oestrogen therapy the usual side effects have also been numerous. These for the most part have not been serious, consisting mainly of variable breast changes, shrinkage of the genitalia and occasional nausea and vomiting. It has rarely been necessary to curtail treatment on this account but a few cases have been treated by implanting oestrogen pellets subcutaneously (an inefficient method owing to the slow rate of absorption) or by resorting to castration. In patients showing relapse during sustained oestrogen treatment, castration has been ineffective in securing any notable further response.

Irrespective of castration or continued oestrogen therapy it is now widely recognised that many tumours which initially respond subsequently show reactivation. While at this stage some undoubtedly become autonomous and immune from further endocrine control, others are considered to be stimulated by a compensatory production of androgens from extra-gonadal sources. With regard to the latter, the adrenal glands appear to be most important and, with the availability of cortisone

as a substituting agent, it is sometimes possible to obtain a further measure of growth-control by adrenalectomy.

Adrenalectomy.

The operation, which is preferably conducted in two stages in the elderly, is well tolerated and, provided that the régime of substitution therapy (Table XIII) is carefully adhered to, carries little risk. Post-operatively a majority of patients are subsequently maintained on 50 mg. of cortisone daily but are also given an additional supply for emergency use should they later contract an intercurrent infection.

TABLE XIII
TOTAL ADRENALECTOMY PRE- AND POST-OPERATIVE RÉGIME

DAY :				
Op-2		Cortisone Acetate (Divided doses)	200 mg. I.M.	Salt (oral) 4 gms.
Op-1		Cortisone Acetate (Divided doses) With D.O.C.A.	200 mg. I.M. 5 mg. I.M.	Salt (oral) 4 gms.
Operation for 9.0 a.m.	6.0 a.m.	Cortisone Acetate	100 mg. (oral)	
	Noon	Cortisone Acetate	50 mg. I.M.	
	Thereafter	Cortisone Acetate (D.O.C.A. 200 mg. implanted subcutaneously at operation)	50 mg. I.M.	6 hourly
Op+1		Cortisone Acetate	50 mg. I.M.	6 hourly
Op+2		Cortisone Acetate	50 mg. I.M.	8 hourly
Op+3		Cortisone Acetate	50 mg. (oral)	8 hourly
Op+4		Cortisone Acetate	25 mg. (oral)	6 hourly
Op+5		Cortisone Acetate	25 mg. (oral)	8 hourly
Subsequently		Cortisone Acetate	25 mg. (oral)	Twice daily

Daily measurement of fluid intake and output.

Daily estimation of serum, Na., K., and fasting blood sugar.

Give blood, L. Norepinephrine, Glucose and salt as necessary, also Thyroid extract if required.

I.M. = Intramuscularly

Table XIII. Adrenalectomy for prostatic cancer—régime of substitution therapy.

In selecting cases for adrenalectomy it has been a rule in the present series to submit to operation only those who have shown a previous response to endocrine therapy and have subsequently undergone relapse. For this reason the nineteen patients operated on between 1952 and 1956 were all in an advanced stage of the disease and suffering severe discomfort from widely disseminated metastases. Contemporaneously twenty-nine cases of advanced mammary cancer were also submitted to operation and the combined results give some indication of the potentialities of this method in inducing further growth regression.

In the combined series of forty-eight cases there was one operative death and four patients failed to survive for more than a week. In the remaining forty-three patients subsequent relief of metastatic pain was a constant feature in all cases with bone deposits, and marked improvement of dyspnoea was noted in the majority with pleural and pulmonary metastases. One case of mammary cancer with an ulcerating tumour attached to the thorax healed completely and rapid disappearance of multiple subcutaneous nodules was seen in several others. Despite the constant relief of metastatic pain repeated radiological examination seldom

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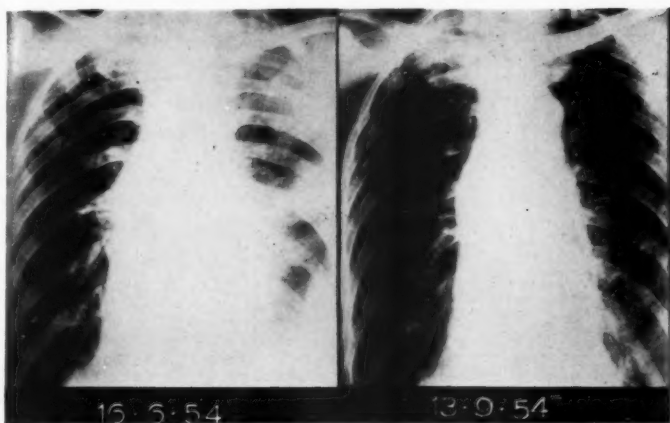


Fig. 1. Regression of pulmonary deposits in a case of breast cancer submitted to adrenalectomy.

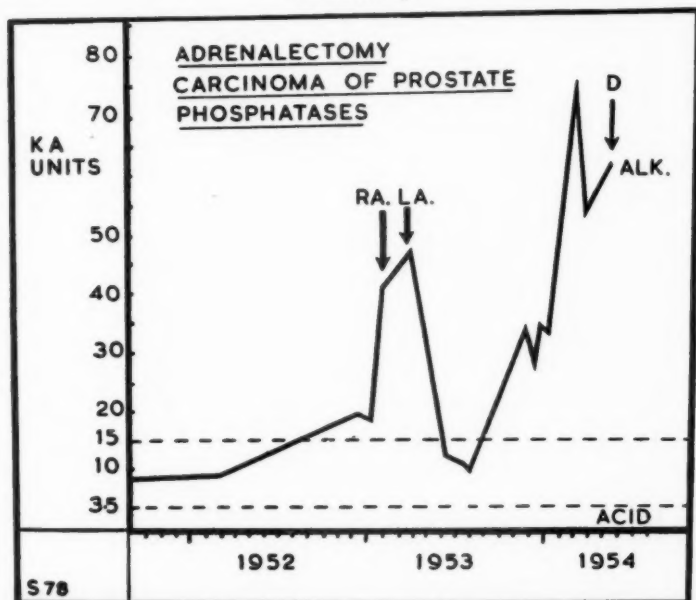


Table XIV. Prostatic cancer. Graph showing rise of serum alkaline phosphatase (associated with increased activity of bone metastases) prior to adrenalectomy, followed by a sharp fall after operation. Only a temporary response was achieved in this case, the serum value rising again as activity returned.

R.A. = Right Adrenalectomy.

L.A. = Left Adrenalectomy.

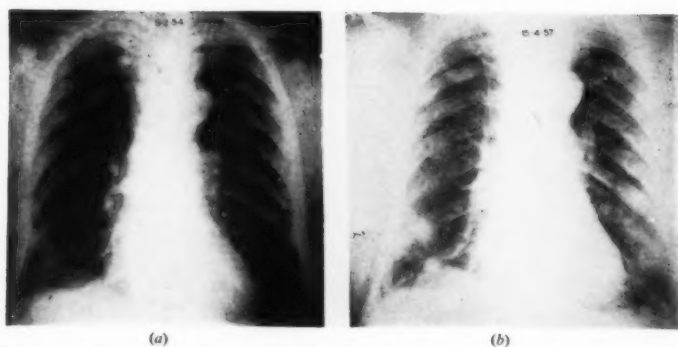


Fig. 2. Pulmonary deposits in a case of prostatic cancer: (a) Before operation; (b) Three years later.

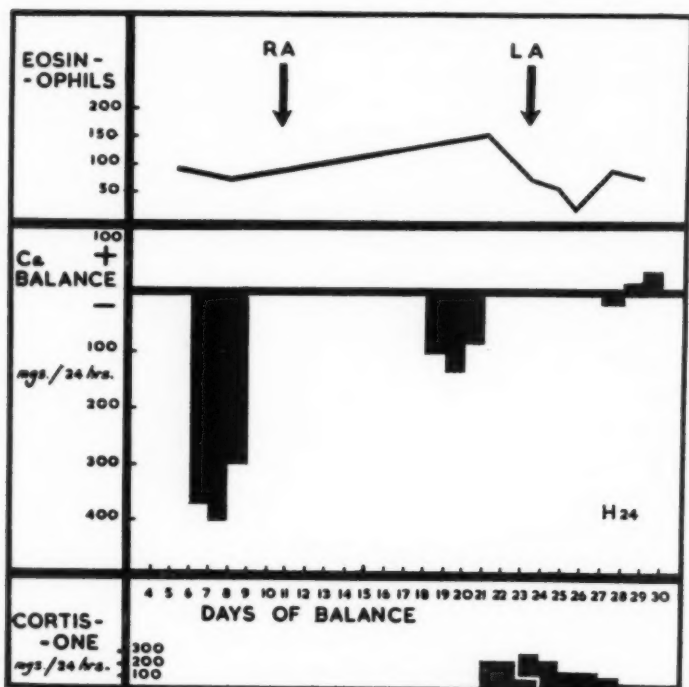


Table XV. Urinary calcium loss in a case of breast cancer with widespread osteolytic deposits, submitted to adrenalectomy.

R.A. = Right Adrenalectomy.

L.A. = Left Adrenalectomy.

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showed any change in the appearance of bone deposits in the prostatic cases. In two cases of pathological fracture, however, spontaneous healing occurred within reasonable time and callus was abundant. Regression of pulmonary deposits was observed in a number of breast cases (Fig. 1), although little change was noted in one prostatic case which survived three years following operation (Fig. 2). No marked alteration in the serum acid phosphatase value was observed in any of the prostatic cases submitted to adrenalectomy but this was already low in most cases at the time of operation. Changes in the serum alkaline phosphatase occurred in some of the cases and may be of significance. The serum value often rises as bone metastases become more widespread and may show a sharp fall after adrenalectomy (Table XIV). Similarly the urinary calcium excretion, often high in cases with multiple osteolytic deposits, may diminish rapidly after operation. In one case of mammary cancer with diffuse bone metastasis (Table XV) the calcium intake was deliberately

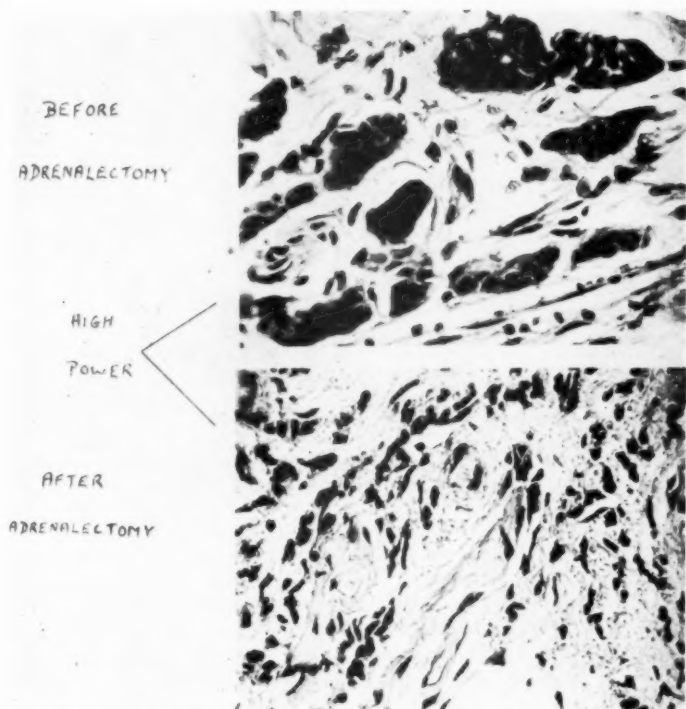


Fig. 3. Histological comparison of two identical subcutaneous metastases in a case of breast cancer: (above) Nodule removed before adrenalectomy; (Below) Nodule removed three weeks after adrenalectomy.

reduced to 200 mg. daily and the urinary output measured on three successive days before operation. The loss in the urine remained high and was computed at 350 mg. a day. Removal of the right adrenal reduced the urinary loss to 100 mg. a day while, after subsequent left adrenalectomy, excretion returned to normal. No cortisone had been given prior to removal of the first adrenal and it seems reasonable to assume that the

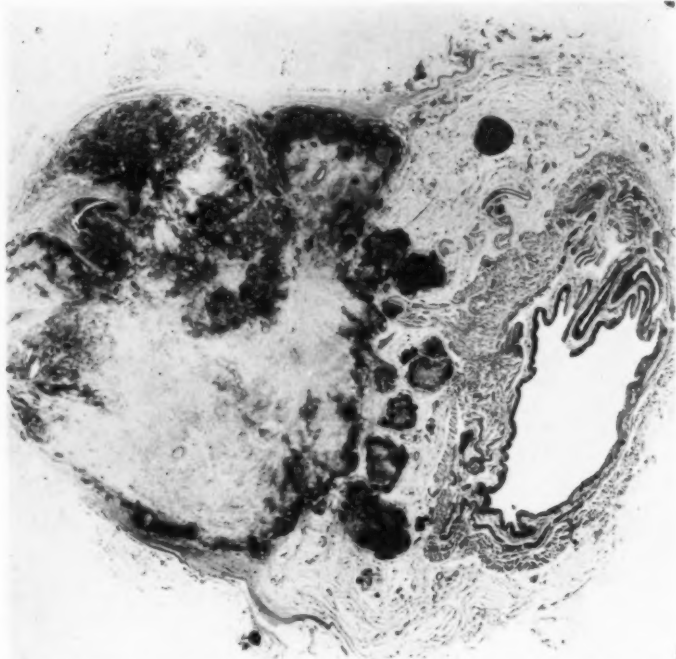


Fig. 4. Cancer of the prostate. Widespread areas of necrosis at the primary site six weeks after adrenalectomy. (Reproduced by kind permission of Dr. L. M. Franks and the Editor of the *British Medical Journal*).

response was thus unconnected with substitution therapy. In this connection it may be added that no objective indication of improvement following cortisone alone has been observed in any member of the series.

Histological evidence of tumour regression has been obtained in two cases, one of mammary cancer in which two identical skin nodules were compared before and after adrenalectomy (Fig. 3) and one of prostatic cancer in which the patient died from a coronary infarct six weeks after operation. The latter showed widespread areas of recent necrosis in the primary tumour as well as in hepatic secondaries (Fig. 4).

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By comparison with the symptomatic improvement the survival periods following adrenalectomy have been somewhat discouraging. This has been more so in the prostatic cases, perhaps largely on account of

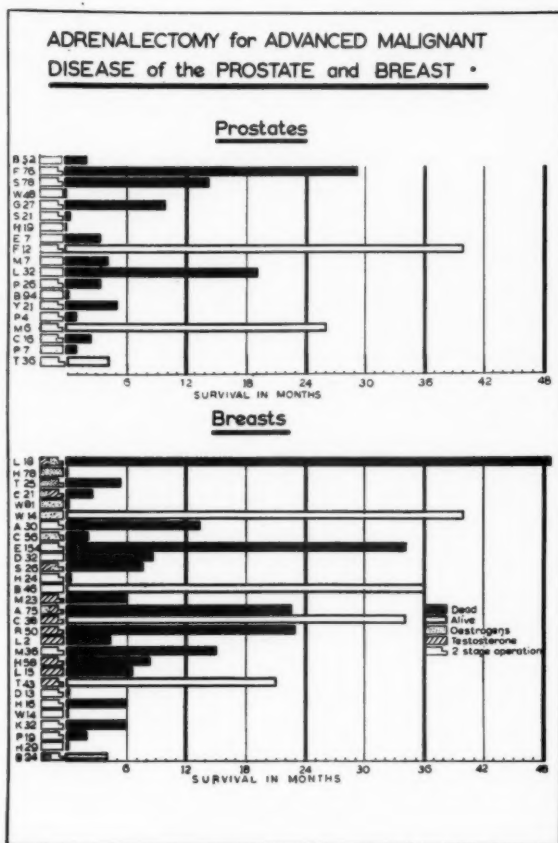


Table XVI. Comparison of survival rates after adrenalectomy in advanced cancer of breast and prostate.

their more advanced age and the greater liability to intercurrent disease (Table XVI). Nevertheless there are good grounds for believing that in some cases a further span of life in comparative comfort has been secured by the operation.

Evidence, however, has recently been adduced to show that a continued elaboration of growth-activating hormones from other sources may continue after adrenalectomy. For this reason attention has recently been

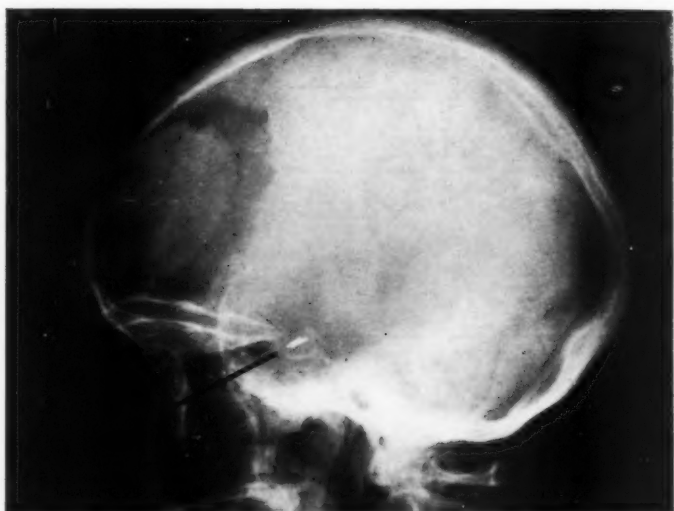


Fig. 5. Irradiation hypophysectomy. Trans-nasal approach showing radioactive yttrium rods in pituitary. A previous attempt at surgical hypophysectomy had had to be abandoned.

IRRADIATION NECROSIS of the HYPOPHYSIS
induced by RADIOACTIVE IMPLANTS .



Fig. 6. Diagram showing zone of irradiation necrosis in the pituitary. Hatched areas indicate position of radioactive implants.

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focused on the pituitary gland with the object of suppressing its activity in stimulating target organs to produce such substances.

Suppression of pituitary function may be achieved either by hypophysectomy or irradiation necrosis and there are now some grounds for supposing that complete ablation is not entirely necessary to produce a clinical effect. This is perhaps fortunate since neither surgery nor irradiation can be guaranteed to secure total elimination of the gland. Surgical

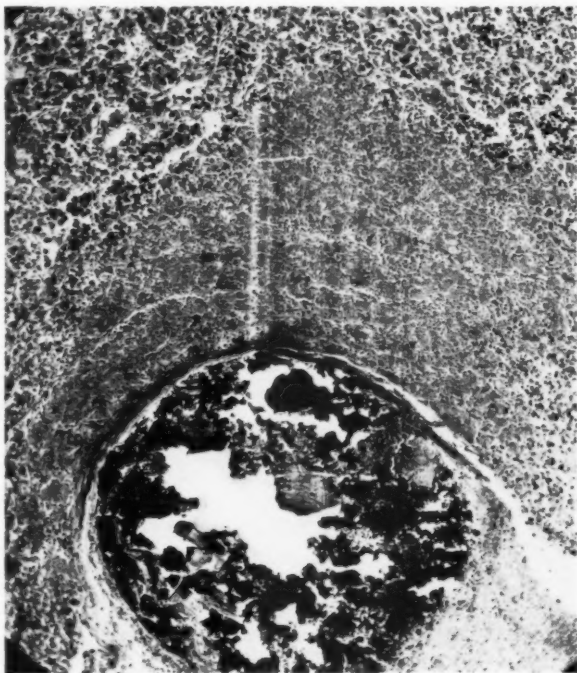


Fig. 7. Microphotograph of pituitary showing concentric zone of necrosis around radioactive implant.

hypophysectomy demands a certain standard of fitness which automatically excludes a proportion of otherwise eligible patients, whereas the trans-nasal introduction of radioactive material into the gland carries little risk. The latter may be accomplished under radiological control either by utilising a method of "dead reckoning" with a precision apparatus attached to the cranium, or by continuous screening using the X-ray image amplifier. In either case a needle introducer is passed through

the nostril and advanced across the sphenoidal sinus into the pituitary fossa. As soon as its position is established a small cylinder of radioactive yttrium (a powerful "beta" ray emitter) is introduced and implanted into the substance of the pituitary (Fig. 5). Two seeds are customarily introduced, one via each nostril, of such combined strength as to produce irradiation necrosis of a substantial area of the gland (Figs. 6 and 7).

While earlier attempts using radioactive gold or radon seeds were often either ineffectual or productive of serious irradiation side effects, the use of yttrium gives promise of greater success. Active necrosis over a radius of 0.5 cms. surrounding each seed can now be assured and, if the latter are correctly deposited, this will induce suppression of pituitary function.

The degree of inactivation produced can only be measured indirectly either by estimation of urinary endocrine excretion or by determining changes in the radioactive iodine uptake by the thyroid. Substitution therapy with cortisone (usually 25 mg. daily) is required post-operatively.

Possible complications of the technique include leakage of cerebro-spinal fluid through the nose, low grade meningitis, and an irradiation effect on the optic chiasma. Partial or complete blindness has been noted after the deposition of radon seeds but has so far not been recorded with yttrium. Meningitis is, to a large extent, precluded by the combined effect of the radioactive material and the use of antibiotics at the time of operation. Owing to technical difficulties the calibre of the yttrium cylinders is of such dimension that a sizeable perforation of the sella turcica has to be made for their introduction. This predisposes to subsequent leakage of cerebro-spinal fluid and rhinorrhoea with associated hypotensive headaches which may occasionally be troublesome for a time. Spontaneous arrest is, however, the rule.

In a series of twenty-five cases of advanced prostatic and mammary cancer operated on by this method some of the results have been encouraging although a number of patients have failed to be relieved. Three cases of prostatic cancer perhaps deserve special mention. In two of these gross oedema of the lower extremities due to lymphatic blockage has now completely disappeared, while in the third, recovery from paraplegia due to spinal deposits and relief of urinary retention has taken place.

This patient remains alive and well nearly eighteen months after the operation. The method, however, can still only be regarded as being in an experimental stage and further experience and technical elaboration will doubtless determine its final place.

I am greatly indebted to Dr. L. M. Franks and Dr. Stretton Young of the Imperial Cancer Research Fund Laboratories and to Mr. G. F. Murnaghan, Research Assistant at the Institute of Urology, for their assistance in the preparation of this lecture. I would also like to thank Miss F. Wadsworth and Mr. R. E. Bartholomew for their help in preparing the illustrations in the Department of Medical Art and Photography at the Institute.

CANCER OF THE OESOPHAGUS

Lecture delivered at the Royal College of Surgeons of England

on

18th April 1957

by

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THE SURGEON WHO sets out to tackle the problem of oesophageal cancer must not be easily discouraged. Apart from the fact that the typical patient is an old man between sixty-five and seventy years of age with a damaged heart and lungs and generalised arteriosclerosis, there are peculiar difficulties inherent in the anatomy, pathology, diagnosis and operative technique which all combine against the hope of obtaining any gratifying series of five-year survivals.

The anatomy

At the upper end, in the neck and superior mediastinal segment, it is not feasible to combine removal of the growth with sufficient regional lymph-nodes, owing to the important structures surrounding it and the narrowness of the thoracic inlet. It is also frequently impossible to remove sufficient oesophagus on each side of the growth.

In the mid-thoracic segment the oesophagus is least accessible. Here it lies between the aorta and the azygos vein and is in relation to the left auricle, the left main bronchus, the inferior pulmonary vein, the thoracic duct and the recurrent laryngeal nerve.

The lower third of the oesophagus is more favourably situated and permits a more radical operation, both in the length of the tube that can be removed and of neighbouring structures and lymph-nodes. Blood supply is from the inferior thyroid and subclavian arteries above, the bronchial arteries and direct aortic branches in the middle and the left gastric and inferior phrenic arteries below. This segmental blood distribution is important in the selection of the level of anastomosis which should not be too far below the aortic arch where the supply is to be from the aortic and bronchial arteries, and well above the arch where it is from the inferior thyroid and subclavian arteries (Robertson, 1954).

The lymphatics of the oesophagus run freely in the loose submucous coat and have widespread communications through a mesh of lymphatics surrounding the outer coat with the posterior-mediastinal, paratracheal, coeliac and supra-pancreatic glands. The spread is downwards and often reaches distant glands when nearby ones are unaffected.

The anatomical structure of the tube itself is against the surgeon. Except for a short subdiaphragmatic section it is devoid of any serous coat like the peritoneum—that great ally of the abdominal surgeon, but more than that it is composed of an inner circular muscle coat and a very friable outer longitudinal coat. The mucous membrane lies loosely on the

inner circular muscle. Any attempt to counteract tension in an anastomosis by strong, firmly tied sutures is doomed to failure as the sutures pull through.

Pathology

The growth is usually a squamous celled carcinoma with a high malignancy which may produce a localised fibrous stricture, may form a carcinomatous ulcer or, rarely, may project into the lumen in a polypoid form. Adeno-carcinomata may arise in the lower end from an extension of a growth of the cardiac end of the stomach, or, rarely, at higher levels from islets of ectopic gastric mucosa.

The principle of a radical removal of the primary growth with a wide margin of surrounding normal tissues, and a block dissection of the regional lymph glands is impossible to follow in the oesophagus. In the upper and middle third surrounding tissues cannot be removed, neither can a proper block dissection be done. In the lower third a more adequate removal is possible and Allison's procedure of excision of the greater part of the stomach with the left gastric lymph-nodes, the spleen, the tail of the pancreas, the great omentum and a cuff of diaphragm around the oesophageal hiatus, fulfils nearly as is expedient the demands of an adequate block removal.

There is an atypical form of growth at the lower end which is described variously as a sarcoma, or a carcino-sarcoma, or a carcinoma with spindle celled reaction in the fibrous stroma. This is difficult to distinguish macroscopically from a leiomyoma which may occur in the same portion and can be shelled out without opening the oesophageal lumen.

The relative frequency of origin in the three different situations of upper, middle and lower thirds seems to be a matter of debate, but if the adeno-carcinomata arising from the upper end of the stomach are excluded, it would appear that the most frequent site (about 50 per cent.) is in the middle segment, which is the most difficult of access.

Blood stream spread is not common except in the adeno-carcinomata of the lower extremity, but in other sites the lymph-nodes—as would be expected—are invaded early in the disease.

Sweet (1954), who appears to have more operable cases in his series than other authorities, reported that lymph-node invasion was present in 57.5 per cent. of his operable cases. (In his experienced hands there was a five-year survival rate after operation of 17.5 per cent. of cases of carcinoma of the lower end, but only 4 per cent. of the mid-thoracic cases; but these figures discounted the operative deaths.) The upper end gave exceedingly unfavourable results and were not included in this report.

Of all cases at any level his five-year survival rate was 40 per cent. where there was no lymph-node invasion and 13.5 per cent. where the nodes were invaded, showing the great importance of early diagnosis.

Diagnosis

Symptoms do not occur early in the disease or are too slight to make the patient or his doctor seek specialised investigation. There seems to be also a serious delay in the average case between the time of first reporting and the institution of treatment, whether by surgery or irradiation.

The onset of established dysphagia is unfortunately the commonest reason for full investigation. The earlier sense of fullness behind the sternum and a slight intermittent difficulty in swallowing are common in many other diseases, even in anxiety states, and it must be remembered that the majority of cases are above sixty-five years of age and have cardiac and respiratory troubles as well. Occasional regurgitation of mucus may be the first symptom but is rarely regarded seriously.

In Sweet's 1954 analysis of 254 patients submitted to surgery 57.5 per cent. showed lymph-node involvement. In an earlier communication (1948) he reported a 70 per cent. involvement which showed that in his clinic at all events an improvement in early recognition of the disease had become possible. The feasibility of earlier diagnosis will be discussed later. It is clearly one of the major problems to be tackled in any attempt to improve results.

At the upper end, unfortunately, the first symptoms are usually those of spread to neighbouring structures, either a paralysis of the recurrent laryngeal or enlarged glands at the root of the neck (Allison, 1949). Before this there may have been merely a slight mucous regurgitation or pharyngeal catarrh, rarely ascribed to an oesophageal growth. Moreover, the lesion often does not show in a barium swallow, but is revealed by oesophagoscopy at which a biopsy can be taken.

When stenosis occurs the nature of the disease may be diagnosed radiologically, but—and this is particularly so in the mid section—it is difficult sometimes at this stage to see the actual ulcerated growth or take a biopsy through an oesophagoscope owing to the submucous extension of the growth above the ulcer. Dilatation to obtain a satisfactory biopsy is dangerous and this accounts for the large number of negative biopsies.

Bronchoscopy may show extension of the growth to trachea or bronchus and will demonstrate the origin of those growths of the bronchus which have infiltrated the oesophagus to produce symptoms of carcinoma of the latter.

Differential diagnosis

Difficulty may be experienced in distinguishing a carcinoma of the lower gullet from a stenosis produced either by ulceration from a chronic peptic ulcer or constricting oesophagitis and fibrosis following on incompetence of the cardiac sphincter. This is usually accompanied by radiological evidence of a hiatus hernia, but may be present without this. The patient has a history of acid regurgitation or vomiting, particularly when lying down at night. There may be an oesophagitis or fibrosis at the

lower end and sometimes carcinoma supervenes upon a chronic oesophagitis. Even after barium swallow and oesophagoscopy it may be impossible to be certain of the diagnosis, and in such cases exploration will be required. Other causes of stenosis, such as cardiospasm, are usually more easily diagnosed on the history and typical radiological appearances. It should be always borne in mind, however, that cancer and cardiospasm may occur together and that oesophagoscopy must always be performed. A supradiaphragmatic constriction points to a malignant cause.

Sometimes tuberculous lymph glands become adherent and distort the tube. They may even erode into it or the bronchus: calcification may show up on X-ray.

Causes of pressure on the oesophagus from outside are aneurysms, enlargement of the heart, mediastinal tumours and secondary glands, and also bronchogenic carcinoma.

At the lower end leiomyomata grow under the mucosa and produce obstructive symptoms. They are vascular and like the leiomyomata of the stomach and duodenum often produce bleeding. These produce the typical radiological picture of a smooth filling defect at the lower end. The Plummer Vinson syndrome of anaemia, achlorhydria and glossitis may cause dysphagia and frequently ends in a carcinoma.

Surgical methods

These may be classified as, first, attempts at extirpation of the disease, and, secondly, palliative methods.

In the second group most authorities are agreed that the patient should have the power of swallowing restored and that resort should never be made to a gastrostomy, except as a temporary nutritive measure. In very late cases, however, this measure frequently fails to produce enough improvement to permit the use of methods to re-establish swallowing and, slight though the operation may be, carries with it a high immediate mortality. Whatever methods of removal are employed, and for each level these are so many and varied that it would be confusing to detail all of them, certain general principles must be followed. (1) There must be an adequate removal of the oesophagus above the growth to clear any submucous extension and a rapid section should be made by the pathologist to confirm that this has been done. (2) There must be no tension at the anastomotic line at the conclusion of the operation. This is assured by adequate mobilisation of the stomach or Roux tube employed, and by fixation of the latter to the mediastinal pleura and to the diaphragm. (3) The possibility of a gap between sutures is best avoided by a continuous catgut suture through the mucous coat, that of the oesophagus being cut below the muscle owing to its tendency to retract. A second and third line of unabsorbable sutures are placed around this invaginating the oesophagus slightly into the stomach. (4) Special points in the anaesthetic technique are the prevention of regurgitation of oesophageal secretions

CANCER OF THE OESOPHAGUS

during the operation by packing or by constant suction of the upper end, and the use of a special airway to intubate one bronchus and block that of the thoracotomy side.

METHODS OF REMOVAL

Exposure may be through a left thoraco-abdominal incision, an abdominal or a thoracic incision alone, or separate abdominal and right thoracic incisions.

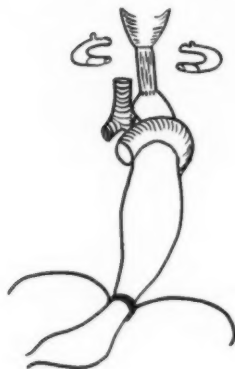
Carcinoma of the upper third

As already stated these tend to present with metastases in the root of the neck and/or recurrent nerve palsy. In such instances irradiation is the best method of treatment. Smithers (1957) reports a five-year survival rate of 11.5 per cent. at this site as compared with none in Sweet's cases treated by excision. The methods of excision often include removal of the pharynx and larynx but a localised removal may be done if the growth is below the cricoid with continuity restored by a turned-in skin flap (Wookey, 1942); otherwise a combined thoracic and cervical removal is required and continuity restored by a Y loop of jejunum or tube of stomach. This was often made subcutaneously by tunnelling in front of the chest wall. A much better method is to separate the diaphragm anteriorly from the costal cartilages and xiphoid on each side of the midline and with finger dissection to make a substernal tunnel to the root of the neck in front of the pericardium, displacing laterally the pleural reflection on each side. This requires a shorter length of jejunum and lessens the risk of an avascularised upper end. Another safeguard against this catastrophe—and this applies wherever a long loop of jejunum is to be used—is a carefully planned freeing of this tube. The selection of branches of the superior mesenteric artery is facilitated by placing a strong light behind the loop to show up the arterial arcades. The peritoneum must be divided right up to the bowel itself and the free end must be a healthy colour and show some faint arterial pulsation.

Carcinoma of the middle third

Here, compared with the lower third, not only are the technical problems greater, but an adequate regional dissection is less possible and the operative mortality is much higher. The growth here is usually a fibrous structure which infiltrates towards the aorta, azygos vein, trachea and main bronchi.

The methods of removal advocated are so many that it is difficult to choose a standard method. The approach may be by a left thoraco-abdominal incision using the bed of the seventh, eighth or ninth ribs and continuing this through the abdominal wall in order to mobilise the stomach. One other approach which should be mentioned and may well become standard for all growths other than those in the upper third, is the method advocated by Ivor Lewis (1946) and followed by Macmanus



SUPRA-AORTIC GASTRO-OESOPHAGEAL
ANASTOMOSIS

Fig. 1.

(1949). This entails two separate incisions, one abdominal and the other a right thoracotomy at an appropriate level, which may be any rib between the fourth and the ninth. The oesophagus can be mobilised without interference from the aortic arch and needs only a division of the azygos vein. The stomach can be brought up into the right pleural cavity more easily by dividing the right crus of the diaphragm. If attacked from the left side the aorta must be freed from the oesophagus by division of some of the upper intercostal arteries. The vagus nerve is then divided below the recurrent laryngeal branch. The diaphragm is split down to the oesophageal hiatus and the stomach is then freed by dividing all the vessels except the right epiploic and pyloric ones and the stomach lifted posteriorly from the pancreas at the pylorus. All this is necessary to provide enough stomach after section at the cardiac end to reach the level of section of the oesophagus. This is easily done, in fact, the stomach so mobilised can be brought up as far as the suprasternal notch. The anastomosis may be made above the arch either by drawing the oesophagus behind it, the arch helping to fix the stomach and prevent tension on the anastomosis (Fig. 1) or by bringing the stomach in front and to the left of the arch which is easier but makes for a less snugly lying junction (Fig. 2). Tension on the anastomosis is lessened by stitching the stomach to the mediastinal pleura and to the diaphragm.

If it proves impossible to provide enough length of stomach to reach the level of oesophageal resection, a tube of jejunum must be prepared by the method already described and the upper end of the stomach closed.

There is some disagreement as to whether the phrenic nerve should be

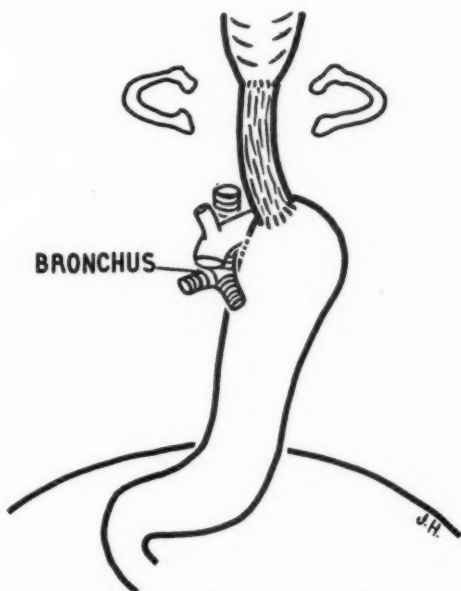
CANCER OF THE OESOPHAGUS

crushed or not. A temporary paralysis of the diaphragm lessens the risk of movement and perhaps tension on the stomach with resulting pull on the anastomosis, but increases the risk of post-operative basal lung complications by abolition of the diaphragmatic action preventing collapse. In any event the diaphragm without any crushing of the nerve remains inactive for some days after thoraco-abdominal incision and crushing of the nerve is unnecessary.

Carcinoma of the lower third

Growths in this situation provide the clearest indication for surgery. Every abdominal surgeon may be required to perform an excision of part of the oesophagus for carcinoma of the cardiac end of the stomach and the techniques employed are the same as for excision of growths of the lower third of the oesophagus.

A left thoraco-abdominal approach or Lewis's method of separate abdominal and right thoracic incisions should be used. The latter has the advantage that there is no division of the costal margin which is a cause

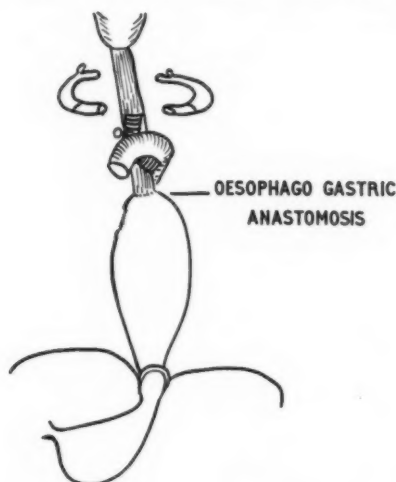


**SUPRA-AORTIC GASTRO OESOPHAGEAL
ANASTOMOSIS**

Fig. 2.

of much post-operative pain and hinders deep breathing and coughing. The oesophagus should be divided as high as is convenient for the making of an oesophago-gastric anastomosis. Apart from the important consideration of a division of the oesophagus well above the growth, there is the further advantage of an anastomosis near the aortic arch that a better blood supply is assured. The lower end of the oesophagus obtains most of its blood supply from vessels divided in the freeing of the stomach and depends thereafter on vessels from the bronchial arteries and the aorta itself near the arch. With the chest opened there is, therefore, no reason for a division of the oesophagus any lower than is necessary to make the anastomosis without hindrance from the arch of the aorta, that is, about two inches below (Robertson, 1954) (Fig. 3).

Late stricture formation at the suture line has been reported. Allison thinks this due, in oesophago-gastric anastomosis, to peptic ulceration,



SUB-AORTIC GASTRO OESOPHAGEAL ANASTOMOSIS

Fig. 3.

but this is unlikely with a vagotomised stomach. Two technical points should be remembered to avoid stenosis; firstly, the mucosa should be cut lower down than the muscle coat, as it tends to retract and leave a raw muscle area favouring stricture formation; also, a circular area of muscle stomach wall should be excised as in the excision of skin for forming an ileostomy.

Operations for growths of the cardia involving the lower end and for growths of the lower oesophagus, have been performed entirely from the

CANCER OF THE OESOPHAGUS

abdomen by mobilising the left lobe of the liver and if required removing the xiphisternum. The oesophagus can be mobilised and brought down for some inches. This has a lower mortality than the abdomino-thoracic approach but sufficient length of oesophagus above the growth cannot be removed without too much traction and subsequent retraction of the tube. This method is sometimes used for carcinoma of the cardia involving the oesophagus but pathological examination frequently shows a line of section through submucous extension of the growth.

POST-OPERATIVE CARE

The important points in the management of the case after oesophageal anastomosis are the prevention of the major causes of death.

Lung complications

Deep breathing and coughing must be re-established as soon as possible to encourage the expansion of the collapsed lung. Antibiotics must be used to prevent infection of the fluid which always collects and underwater drainage must be established with constant radiographic checks of the lung expansion.

A high proportion of hospital deaths are due to cardiac failure. This is largely due to poor oxygenation of the heart muscle, and oxygen should be given by means of an inhaler or oxygen tent in the immediate post-operative period.

Another cause of intrathoracic trouble is distension of the displaced stomach. It must be remembered that this is a vagotomised organ and stasis is to be expected. For this reason a soft tube may be passed through the anastomosis into the stomach for frequent aspirations. Some surgeons dislike an indwelling tube which they say endangers the anastomosis by causing pressure necrosis, and advise an intermittent use of the tube. A Ramstedt's operation on the pylorus as suggested by Tanner (1951), and which adds little to the extent of the operation, seems a well worth while procedure to lessen gastric stasis.

Minor leakages from the anastomosis are a major cause of operation mortality and will infect the pleural space often in spite of antibiotics causing an empyema.

No fluids other than a little plain water should be given by mouth for at least three days to give every chance of a watertight healing of the suture line. A major leak demands a very hazardous re-exploration and resuture.

PALLIATIVE METHODS

1. Surgical

To enable patients to regain the power of swallowing where the growth is irremovable, by-pass operations can be done. This may be via a Roux tube with a side to side or end to side anastomosis above the growth, or by utilising a mobilised portion of the stomach.

2. Intubation

A Souttar's tube can be inserted by an oesophagoscope through the stricture. The tube sometimes slips into the stomach, but the stricture can subsequently be kept dilated by bougination.

3. Irradiation

Irradiation is included in this heading although there is good evidence that in growths of the upper end it at present has better results than surgical excision (Smithers, 1957). At the Royal Marsden Hospital (and its results are paralleled by other centres whose results are reviewed by him) the best results from X-rays are obtained in this area and comprise the vast majority of the 11.5 per cent. five-year survival rate in the upper end growths at that hospital. Combining all the five-year survivals following any treatment from a survey of world literature he has evolved a summary of results which shows that at present radiotherapy is easily the method of choice for the upper third lesions, has just over twice the five-year survival rate in the middle third, but lies far behind surgery as a treatment for the lower end. In figures from a survey of world literature from six different centres there are two surgical five-year survivals in the upper third against thirty-three by radiotherapy; seven in the middle third against fifteen by radiotherapy, but sixty-five in the lower third against thirteen. From this it would appear that surgery should not be chosen for the upper third growths; and, remembering the high operative mortality for the middle third, that its use is still debatable in that section. For growths in the lower third surgery is clearly preferable. Nevertheless, Neilson (1945), after evaluation of results of rotation therapy states the opinion of Scandinavian radiotherapists: "To us, there is no doubt that the difficult task of trying to treat oesophageal cancer, both radically and symptomatically, will to a very great extent continue to be the domain of radiotherapy. All imaginable advances of thoracic surgery notwithstanding, only a small percentage of carcinomas in the oesophagus will be amenable to surgical treatment, and the number of these in which a complete cure will be attained will be smaller still."

It must be remembered, however, that surgery of this organ is in its infancy. An indication of the tremendous progress made is shown by the fact that in 1943 Smithers found only one case reported in the literature who had survived five years after operation. This was Torek's case who had a tumour with probably a low degree of malignancy as he had had symptoms for nine months before treatment. In addition, in fact, there were at least Evans's (1933) and Trotter's (1937) cases. For the lower end there is now in the best hands about a 10 per cent. five-year survival. In the mid-section no great improvement seems to have been made in this respect. Sweet reports a 4 per cent. five-year cure but this figure does not include the hospital deaths (thirty out of 120), a quarter of the cases of those submitted to operation. With these included, the 4 per cent. becomes

less than 2 per cent. and from the collective figures of five-year cures given by Smithers, radiotherapy, avoiding the ordeal of a severe and dangerous operation, would seem preferable. Also, while surgical methods are clearly improving, newer and better forms of radiotherapy are also becoming available.

NEW METHODS UNDER TRIAL

1. The use of plastic tubes

There is no doubt that food can be propelled by the act of deglutition down artificial tubes. A rubber tube attached to the cut upper end and passing down the front of the chest to connect with a gastrostomy opening worked well for many years in Evans's and Terek's cases. There are also a number of successful cases since Sampson's first remarkable one (1933) of a skin tube being fashioned to bridge the same gap. The use of plastic tubes within the thorax, to replace resected portions, has been the subject of experiments by Berman (1952). Flexible polyethylene tubing was considered to be the best medium. Of twenty dogs in whom excision and replacement with this artificial canal had been carried out, five died of post-operative chest complications and in them it was found that at four days, which was the earliest death, a thin gelatinous sheath was found to surround the tube completely. At twenty-three days a firm fibrous tissue sheath 2 to 3 mm. thick was present. One dog sacrificed at 108 days showed a new oesophageal coat of 4 mm. thickness which had blended with the two cut oesophageal ends and was lined by an epithelial layer. This latter was incomplete at that date but at one year was found to be a continuous squamous epithelial coat. Subsequently, seven human patients were treated by this method and the author promises his report on these at a later date.

2. The Boerema button

This is an apparatus recently devised by Professor Boerema of Amsterdam for total gastrectomy. It consists of a plastic button of the Murphy type, about $\frac{3}{4}$ in. in its maximum diameter. This is attached to a long flexible introducer which passes down into a mobilised jejunal tube. One half of the button is secured in the lower end of the cut oesophagus by a purse string suture, and the other half, to which the introducer is attached, is similarly fixed to the jejunum. The two ends are then clamped together after which the introducer is withdrawn from below. The upper half of the button has long threads which are passed up through the oesophagus and out through the nasopharynx. These enable the button to be drawn upwards after twelve days when it sloughs free. This is claimed to lessen the risk of anastomotic leakage and makes a very rapid oesophageal anastomosis. When sloughing is complete a firm tissue reaction has sealed off the anastomotic line.

REVIEW

At first sight the results of oesophageal surgery are depressing. The high mortality, the technical difficulties involved, and the high morbidity have often influenced medical opinion against operation on these cases. In the recent past the majority were admitted to surgical wards only for gastrostomy. This does not relieve the symptoms or restore the enjoyment of food and drink, that most essential and primitive need of man, and at best only prolongs a miserable existence for a short time. It increases the difficulty of operation if this is subsequently advised and all authorities are agreed in its condemnation. Nutrition is best restored by intravenous fluids.

When considering the results it must be remembered that the disease occurs pre-eminently in the old and feeble, often arriving for treatment many months after the onset of symptoms. Also that there has been a steady improvement in surgical results in recent years. We can now be definite that for carcinoma of the lower third and for growths of the cardia invading the oesophagus, surgery offers the patient a good chance of surviving the operation, a 10 per cent. chance of a five-year cure and living free from symptoms for a year or two and should be advised in any case not too far advanced. Radiotherapy here has poor results. Another reason for advising operation in this site is that a less malignant or even



Fig. 4. Mrs. E. C., aged 65, on admission, August 1955.

CANCER OF THE OESOPHAGUS



Fig. 5. Specimen removed from lower end of oesophagus.

benign condition may be found which can be improved. An illustrative case is that of a female patient, aged sixty-five (Fig. 4), who was admitted to the Westminster in August 1955 with a history of eight weeks' dysphagia and mild substernal discomfort, with a loss of two stones in weight in two months. A barium meal showed a lobulated tumour which appeared to prolapse into the fundus of the stomach. An oesophagoscopy showed a smooth-walled tumour arising from the left lateral wall. A biopsy fragment was reported on as being a leiomyosarcoma. At operation (Mr. Charles Drew) the mass (Fig. 5) was found to be arising from a small pedicle at the cardio-oesophageal junction; it was excised through a gastrostomy incision. A gland from the lesser curve and from the mediastinum showed invasion by squamous carcinoma and the tumour itself was reported on

by Dr. Morgan as being a carcino-sarcoma. The sections were sent to Professor Willis, who gave his opinion that the tumour was wholly carcinomatous, the sarcomatous appearance being the result of diffuse growth of spindle shaped epithelial cells with great desmoplastic proliferation of the invaded connective tissues (Fig. 6). This patient is now, twenty-one months later, asymptomatic and has gained two stones in weight (Fig. 7).

For growths in other segments it may be said at present that growths of the upper third are better treated by radiotherapy where the surgical results are the most depressing and those of irradiation the best. Here, too, except for the Wookey operation, in early growths operative treatment involves the use of long segments of stomach or intestine whose viability is always a matter of concern, and of staged operations of considerable technical difficulty.

The middle segment is a debatable site. The surgical mortality is high and the survival rate is poor, and at present radiotherapy seems to offer a better chance of survival. Surgical results are, however, improving and an operation offers a better chance of eradicating the disease in an early stage. Swallowing, moreover, is sometimes only partially restored by irradiation and needs bouginage as well. The tendency is now to use the stomach to restore continuity after resection, with

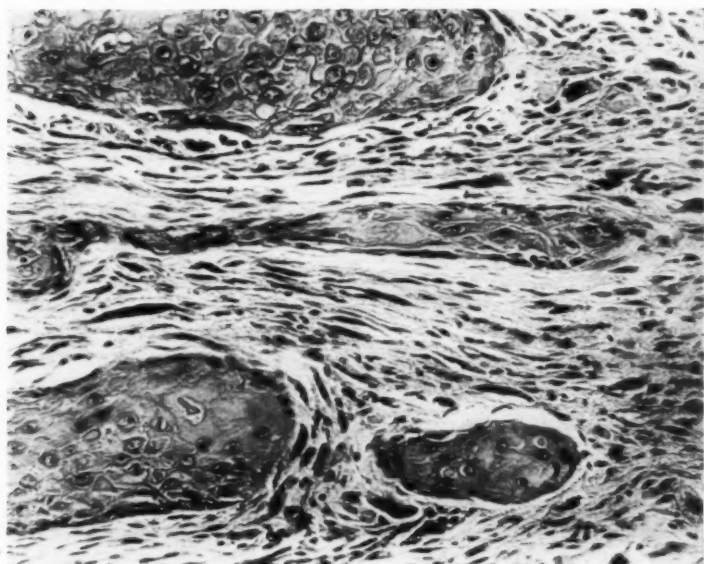


Fig. 6. Section X 130 of tumour.



Fig. 7. Mrs. E. C., April 1957

proper mobilisation it can be lifted a long way into the thorax even sometimes up to the suprasternal region.

Of experimental methods the possibility of the use of plastic tubes is interesting. The curious but well-demonstrated ability of arteries to reconstruct themselves around similar grafts shows that tissues are anxious and able to reconstruct themselves when mutilated, and Berman's experiments show that this reconstruction is possible in the oesophagus. If such artificial tubes could be successfully used operating time and the restoration of a more normal anatomy would be possible after resection of growths of the oesophagus. The Boerema button would also shorten the operation and may cut down the high incidence of leaking anastomosis, but there would seem to be a greater chance of late stricture formation at the anastomosis than in the method usually employed.

THE FUTURE OF SURGERY OF THE OESOPHAGUS

It is clear from what has been said that one of the great problems to be tackled is that of early diagnosis and treatment. The high proportion of cases with glandular involvement arriving for treatment is partly because diagnosis is not made early enough and partly because there is often a long delay between diagnosis and treatment. Difficulty in swallowing, even if temporary, or a sense of fullness behind the sternum after

eating, should be investigated both by X-rays and by oesophagoscopy before true dysphagia sets in, as should any regurgitation of mucus particularly if streaked with blood. A barium swallow with any routine chest X-ray in the elderly might increase the value of that frequently performed examination, not only from the point of view of diagnosis of oesophageal lesions, but as an aid in recognition of other intrathoracic conditions.

A natural and kindly, if mistaken, aversion to advising such an operation in an old and ailing subject is another reason for deferring operation until it is realised that something must be done for the unfortunate patient who cannot swallow his own saliva and is rapidly wasting away.

Unfortunately the latest X-ray therapies are not everywhere available and delays occur in getting patients referred to suitable centres. The same applies to their coming under the care of surgeons with experience in this branch of surgery, which, more than most alimentary conditions, demands an experienced team.

There are no recorded series of any large number of patients treated by a combination of radiotherapy and surgery, which may perhaps in the future show improved results.

It would seem obvious that each case should on admission, or reporting to hospital, be seen by surgeon and radiotherapist and treatment decided after full consideration and co-operation between the two. At present it is too frequently decided by the fact that they have been referred to one or the other by their own doctor and there is perhaps even, as Smithers hints, a competitive element present.

Surgical techniques aimed at lessening the risks of anastomotic leakage and lung complications are being constantly improved, and earlier diagnosis is becoming possible. There are many operations now standardised in other parts of the body adding greatly to the cure and relief of humanity, which in their early history had results no more hopeful than those of excision of cancer of the oesophagus, and there is no reason to doubt that the surgery of this organ will progress in like manner.

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MARY SABINA, THE VARIEGATED DAMSEL

Jessie Dobson, B.A., M.Sc.

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IN THE EXHIBITION Hall of the College there hangs a painting of a piebald negro child. The condition shown is very rare; and the picture has many other points of interest. The inscription at the bottom right hand corner reads:

"The true picture of Mary Sabina, who was born Oct. 12th 1736 at Matuna, a Plantation belonging to the Jesuits in the city of Cartagena in America, of two negro slaves named Martiniano and Patrona." (Fig. 1.)

The earliest mention of this case of partial albinism seems to have been that made by José Gumilla, a priest in charge of the Jesuit College at "Cartagena of the Indies," that is, in Columbia. In his book *El Orinoco ilustrado, y defendido, historia naturel y geographica de este gran rio*, published in Madrid in the year 1745, he relates how, when visiting the sick in the plantation hospital, he saw a negress who had with her a six months old child of so extraordinary an appearance that he was convinced he would be accused of exaggeration in his description of it. He advised the mother to guard the baby very carefully lest someone should cast the evil eye upon it: and he mentions that *many careful drawings were made of it*. Gumilla attributed the black and white markings of the skin to the fact that the mother had in her possession before the birth of the child a black and white dog with similar pattern. Naturally, the little girl attracted much attention throughout the district and the directors of the English factory at Cartagena directed that a portrait of her should be made *for despatch to London*.

A further contribution to the story comes in 1765 in a letter addressed to the Earl of Morton, President of the Royal Society, and later published in the *Philosophical Transactions*, written by James Parsons, M.D., F.R.S. This was in reference to a white negro boy who had been brought before the Fellows a short time previously. Referring to similar cases that had come to his notice, Parsons gives the following information that he had received from a lady of his acquaintance formerly resident in Virginia. This was that Admiral Franklin had found upon a captured Spanish ship a picture of a boy who "was as beautifully mottled all over with black and white spots as any dog that ever was seen." Several copies of the picture were made in Carolina and it was said to be the portrait of a child born of negro parents upon the Spanish Main.

In the Monograph on "Albinism in Man," prepared by Karl Pearson, E. Nettleship and C. H. Usher, and published in 1911, it is pointed out, in regard to this case mentioned by Dr. Parsons, that there was no Admiral Franklin on the West Indies station at this period; but there was a Captain Thomas Frankland, afterwards Sir Thomas Frankland, who was stationed in the Bahamas and who captured a Spanish ship,

JESSIE DOBSON

"La Concepcion," bound from Cartagena for the Havannah, which was taken to Charleston, S. Carolina. The mistake about the sex of the child is probably of no consequence.

There is a further complication in this story since Georges Louis Leclerc de Buffon (1707-1788) includes in Volume IV of the Supplement to his



Fig. 1.

Histoire Naturelle an engraving of a piebald child who is indubitably the one described by Gumilla and the subject of the College painting. The original of the engraving, he says, was a coloured portrait sent to him by M. Taverne, formerly burgomaster of Dunkirk, accompanied by a letter dated 10th September 1772 giving the information that the painting

had been found in an English prize captured by the Corsair *La Royale*. Below the picture, says Buffon, was the inscription, in English :

" Mary Sabina, born the 12th October 1736, at Matuna, a plantation belonging to the Jesuits of Cartagena in America, of two negro slaves, named Martiniano and Patrona."

" Je pense," says M. Taverne in this letter, " malgré ce que porte la legende Angloise qui est au bas du portrait de cet enfant, qu'il est provenu de l'union d'un blanc et d'une négresse, et que ce n'est que pour sauver l'honneur de la mère et de la Société dont elle était esclave, qu'on a dit cet enfant né de parens nègres."

In his reply, dated 13th October, Buffon remarks that he had never previously come across such a condition. Though he was at first inclined to agree with M. Taverne that this was the offspring of mixed parentage, he goes on to point out that " lorsqu'on fait reflexion qu'on a mille et millions d'exemples, que le mélange du sang nègre avec le blanc n'a jamais produit que du brun, toujours uniformément répandu, on vient à douter de cette supposition, et je crois qu'en effet on seroit moins mal fondé à rapporter l'origine de cet enfant à des nègres dans lesquels il y a des individus blancs ou blafards, c'est à dire, d'un blanc tout différent de celui des autres hommes blancs . . . Je penserois donc que si quelqu'un des ascendens de cet enfant pie était un nègre blanc, la couleur a pu reparôître en partie et se distribuer comme nous la voyons sur ce portrait."

In a further letter, dated 29th October, M. Taverne gives more precise and probably more accurate details of the provenance of the portrait : " L'original du portrait de l'enfant noir et blanc, a été trouvé à bord du navire ' Le Crétien ' de Londres, venant de la nouvelle Angleterre pour aller à Londres ; ce navire fut pris en 1746, par le vaisseau nommé ' Le Comte de Maurepas,' de Dunkerque, commandé par le capitaine François Meyne." The writer courteously admits that Buffon may be correct about the cause of the condition ; but firmly points out that : " Malgré mille et millions d'exemples que vous citez, que le mélange du sang nègre avec le blanc, n'a jamais produit que du brun toujours uniformément répandu ; je crois qu'a l'exemple des quadrupèdes, les hommes peuvent naître, par le mélange des individus noirs et blancs, tantôt bruns comme sont les mulâtres, tantôt tigrés à petites taches noires ou blanchâtre, et tantôt pies à grandes taches ou bandes comme il est arrivé à l'enfant ci-dessus." And he proceeds to give instances of such markings in horses, cattle, sheep, pigs, dogs, cats and rabbits—so why not in Man ? Indeed, he maintains, it is surprising that it does not occur more often.

Buffon, however, was not convinced, though he could provide no irrefutable proof for his own theory, and, seemingly, the correspondence closed. The engraving that is reproduced to illustrate his remarks was made from the picture supplied by M. Taverne and forms Plate II in



Fig. 2.

Volume IV of the Supplement to the *Histoire Naturelle* (Fig. 2). It is undoubtedly the same child as is shown in the College painting; but the background is entirely changed, the loin cloth is not shown, and the figure is reversed. The last may have been an error on the part of the engraver, for in the *Complete Works of Buffon* this is corrected (Plate 16, Vol. V). What became of the original picture used by Buffon is not known.

In the records of the University of St. Andrews there is evidence of another portrait of Mary Sabina. There it is stated that on 11th May 1753 "a picture of a girl, black and white, born of two black slaves at Matuna in America" was presented to the University by Sir James Home of Beachader. This is no longer in possession of the University nor is there any trace of the time or circumstances of its disposal. It does not seem likely, however, that this was the picture that M. Taverne sent to Buffon in 1772.

Nearly a hundred years elapse before any further mention is made of Mary Sabina or her portraits. In his lectures on dermatology delivered in 1870, Erasmus Wilson makes the following statement about the portrait of "our little variegated damsel": "That original picture having lately come into my possession, I have the opportunity of exhibiting it here on the present occasion. I may remark upon the admirable painting of the work. . . ." In the series of lectures that Sir Erasmus gave in 1876, he added the information that this portrait had been offered for sale to the College. This offer not being accepted, he bought the picture himself and later gave it to the College. Enquiries have not revealed the name of the previous owner or owners and so the problem of the portrait remains unsolved. Were there, in fact, three somewhat similar paintings, one owned by M. Taverne, now lost, one by Sir James Home, also lost, and the third now in the possession of the College, the early history of which is unknown; or was only one portrait brought to Europe, a portrait that seems to have had a somewhat adventurous career?

According to the extensive evidence collected by Pearson, Nettleship and Usher, "the piebald is rare, far rarer than the complete albino." Although it might appear from the historical accounts that the condition was more common a couple of centuries ago, this may be a fallacy, for in many cases the individuals were unnamed and records made by different writers might, in fact, refer to the same person or persons. It is interesting in this connection to mention a case of partial albinism recorded by Johann Friedrich Blumenbach and a water colour portrait of undoubtedly the same individual among John Hunter's collection of drawings (Fig. 3). This was John Richardson Primrose Bobey, who was born on 5th July 1774 at Guangaboo, near Kingston, Jamaica, where his parents were slaves. At the age of twelve he was sent to Liverpool but some three years later came to London where he was bought by a showman named Clarke. It was in Clarke's exhibition at Exeter Change that John Hunter most probably saw him. In 1791, Blumenbach visited London for the second



Fig. 3.

time and on this occasion saw the piebald youth, an illustration and description of whom he included in the third edition of his *Natural Varieties of Mankind*, published in 1795 and dedicated to Sir Joseph Banks.

SOME MEMORIES OF LORD LISTER IN HIS THEATRE IN THE OLD KING'S COLLEGE HOSPITAL IN PORTUGAL STREET

F. A. Hadley, M.B.E., F.R.C.S., F.R.A.C.S.
Consulting Surgeon, Perth Hospital, Australia

AT THE REQUEST of King's College Hospital Lord Lister returned to London from Scotland in 1877 and became a senior surgeon on the staff. He brought Mr. Watson Cheyne as his house surgeon and Miss Monk as his nurse. He still had a hard fight before him.

In 1897 I became Mr. Cheyne's senior dresser, and later his house surgeon until the end of the century. It was at intervals during this period that on several occasions I had the chance of seeing Lord Lister and even of speaking to him. He still enjoyed coming into his old theatre and watching Cheyne operate. This was the very theatre in which he had finally convinced the surgical world of the truth of his theories.

My memory associates him so strongly with this old theatre that I cannot give a living picture of him without first giving, as a setting, some description of it.

The theatre was built in 1845.

The sole objective of the architects was to give as close a view of the operation as possible, to as large a number of onlookers as possible—also to keep the air fresh and more or less pleasant for these onlookers. The dust in the air did not much matter, if there was plenty of air. They therefore built a high domed ceiling, chiefly made of glass to admit as much light as possible.

The floor was tiled, so that it could be swabbed if it became wet. About seven tiers of wooden seats, forming a sort of wide horse-shoe, descended from the back wall, ending about two feet above the level of the floor, upon which stood the operating and instrument tables, but separated by a rail with a curved wood top, upon which the visitors could rest their arms and bend forward, thus not blocking out the view of those on the higher seats. This lowest seat was reserved for visitors and honorary staff, all of whom, as well as the students, were wearing their usual clothing. They also raised a good deal of dust as they descended from a door, high at the back, down to their seats below.

The theatre wall above these seats was white, but let into it were five bas-relief plaques, depicting famous surgeons of the past. No doubt these were dusted at times, but the London smoke, over the years, had permanently blackened their eyebrows, noses, lips and chins. A rather unexpected effect in a theatre planned for surgery.

A modern aseptic-trained surgeon can hardly believe that successful surgery was carried out in such a place and that every surgical wound

would heal by first intention. I can myself vouch for the truth of this, as I dressed many which had not been touched until the tenth day.

The operation list would often be long. Some of the cases, such as a breast with axillary glands, exposed much surface to the air. This was kept covered with swabs wrung out of a weak antiseptic solution.

With this short description as a back of stage setting, I will now describe one of those all too rare mornings when Lord Lister was present.

An operation is in progress. A patient lies on the operating table under an anaesthetic, given by a student dressed in his ordinary day clothes and with his coat on.

A stately old gentleman, with rather long but carefully kept white hair, quietly strolls about, occasionally whispering in the anaesthetist's ear. His frock coat is of rather an earlier Victorian type, but very well cut. This is Doctor Silk, to whom anaesthesia owes so much. Mr. Cheyne, even at that date carrying the honoured letters F.R.S. after his name, is standing at the table operating.

His shirt sleeves are rolled up above his elbows, and he wears a long red mackintosh apron, reaching from his chin to his toes, to keep his clothes dry and clean. His hands he keeps wet by constant dipping in a bowl of weak antiseptic. His house surgeon and two senior dressers are similarly dressed. One is "doing instruments." He takes each instrument, which he thinks will be required next, out of 1 : 20 carbolic, with his bare fingers (rubber gloves did not then exist) and washes it in 1 : 40 carbolic. His colleague stands ready to hold a retractor.

Everything is going normally, when there appears, standing quietly just behind Cheyne's left shoulder, a rather small man. No notice seems to have been taken of his entry. He is dressed in a frock coat with a large bow tie. Two considerable bunches of hair stand out above his ears, whilst from just in front of these tufts, neatly trimmed whiskers extend downwards to about an inch and a half below the angle of the jaw.

At that time this was quite an ordinary fashion for a professional man or for politicians and senior society men; it undoubtedly tended to emphasise the features of a face. Lister's features tell us much about his character: the penetrating steady eyes missing no detail, they made us students somewhat nervous, for fear we had faulted somewhere; the rather broad domed forehead of the deep thinker always wanting an answer to what he observed; the stiff upper lip suggesting some obstinacy, and the undoubtedly determined jaw. Lister's eyes were his microscope. He was not dependent upon laboratories: indeed his greatest discovery was the result of what he observed with his eyes and by asking himself the reason "why."

Returning to the typical morning:

The operation Cheyne is performing is obviously coming to an end. Doctor Silk whispers something to him and he nods. We dressers then know that the next anaesthetic is not to be started. There will be the break

SOME MEMORIES OF LORD LISTER

for tea which we have been so looking forward to, as we will also go into the little room and actually meet the great man and be spoken to by him, perhaps even ask him a question. He may make some remarks about the operation just finished.

I have never, in all the years which have gone since those days, forgotten his telling us "That he himself still knew only a little about these sepsis-causing germs and that there yet remained a vast amount for us to discover."

This from a man who had brought to the millions of the whole world the means of saving vast numbers from suffering and death. So ends the typical morning. We hope that he will come again soon.

Microscopic work and the cultivation of bacteria, various cocci and so on, was of course progressing during Lister's latter years, chiefly carried on by Sir Almroth Wright and others, and no doubt Lister was following this work.

There was one little incident in which to some extent I was involved, but which shows a very human side in his nature. It so happened that early in January 1900 my father sat next to him at a dinner in Trinity College, Cambridge. Noting the name, Lister asked my father whether he had a son shortly sailing for the South African War, requesting him to give me his best wishes. It is true that he knew that his great protégé Cheyne was sailing at about the same time, but it was a very human act, and not one of a man whose whole mind was absorbed in science.

SIR JAMES WALTON

THE LATE SIR James Walton, Vice-President of the College in 1939-40 and 1940-41, was an authority on gem-stones and was awarded the diploma with distinction of the Gemmological Association, of which he became President. He was also Chairman of the National Association of Goldsmiths. These two Associations have established at their headquarters in the City "The Sir James Walton Memorial Library." The January 1958 issue of the *Journal of Gemmology* contains photographs of this library, which is one of the most comprehensive on the subjects of jewellery, gemmology, gold and silver ware, and horology; it also contains specimens of gem-stones and gem-minerals, and models made by Sir James Walton himself. Sir James was probably the first medical man to recognise the importance of understanding the atomic lattice-structure of minerals when dealing with diseases caused by mineral dusts.

LIFE OF SIR GEORGE BUCKSTON BROWNE, F.R.C.S.

A BIOGRAPHY HAS been written of Sir George Buckston Browne, one of the greatest benefactors the College has had, by Miss Jessie Dobson, B.A., M.Sc., and Sir Cecil Wakeley, Bt., K.B.E., C.B., LL.D., F.R.C.S.

The publishers are Messrs. E. & S. Livingstone and the price of the book is 25s. net.

ADDRESS DELIVERED AT THE MEMORIAL SERVICE
held in the
CHURCH OF ST. BARTHOLOMEW-THE-LESS
for
SIR THOMAS DUNHILL, G.C.V.O., C.M.G., M.D., F.R.C.S., F.R.A.C.S.
by
SIR JAMES PATERSON ROSS, K.C.V.O., M.S., P.R.C.S.

WE WHO KNEW and admired and loved Sir Thomas are met together to honour his memory not in a spirit of mournfulness, for that would not have pleased him, but in a spirit of thankfulness, to offer praise to Almighty God and to express as best we may our thankfulness to Him for one who lived a life devoted to the service of his fellow men and women, yet a life which had in it so much besides professional work.

It is a heavy responsibility to speak to you, and if possible for you, because our hearts are full—and then silent thought may be more satisfying than speech. Yet I am accepting the responsibility for two reasons—first because I was privileged to know Sir Thomas almost as a son, and secondly because less than a year ago I had the opportunity of meeting many of his friends in Australia and of finding out more completely than before what he had meant to them.

In Brisbane I met a gentle, humble yet most distinguished retired Canon who had helped Tom to learn enough Latin to enter Melbourne University as a medical student—and as I talked with him I realized that they loved each other as brothers. In Melbourne I met medical men who were his friends from their student days, the theatre sister, now an old lady, who helped him with his first thyroid operations, the lawyers, soldiers and business men who had known him at the club, and the wife of one of his oldest friends who had a special interest in common with him for she is an expert gardener and grows world-famous camellias—all these men and women, and there were so many of them, made me realise how much he counted in their lives, and how difficult it must have been for him to leave Australia and come to work in England, and I gained a clearer idea than ever of our indebtedness to him for accepting the invitation to join the staff of our hospital. But wherever he went he quickly made friends and there is no doubt that the welcome he received in London compensated to some extent for the separation from his older friends in Australia.

The high honours bestowed upon him indicate the esteem in which he was held by the Sovereign and by his professional brethren. His outstanding contributions to the practice of surgery and to medical literature are well known, and are recorded in their proper place. Though not unmindful of them now, I would prefer to lay stress upon the wonderful confidence he inspired in his patients, from the most lowly to the most exalted in the land, for every one of them felt sure that Sir Thomas had a full understanding of his or her individual problem, and that his wisdom and skill would be sufficient to deal with it. To inspire such confidence

SIR THOMAS DUNHILL

cost him tireless study and effort, anxiety and often loss of sleep, yet he never spared himself, and never relaxed until he had either won or lost the fight.

He set high standards for himself and he insisted that those who assisted him—whether house surgeons, or nurses, or instrument makers—should comply with his instructions in minute detail. Other men have alienated the sympathy of their assistants by such tactics; but his associates discovered sooner or later that there was always reason and good reason behind his demands, even the most expert had to acknowledge that they could learn from him, and they all became his devoted slaves, and were rewarded by his approval, his friendship, and even his love.

When training himself as a surgeon he studied the work of the masters; so also in the other interests and pursuits which made up his life he strove to learn from experts—in fishing, shooting and gardening; in the appreciation of pictures, furniture and architecture—and thus became himself an expert. In literature he stuck to his old favourites—Shakespeare, Browning and George Meredith—and he read his Bible diligently and with more critical thought than many a regular churchgoer.

The last few years of his life were saddened (as is inevitable if a man lives beyond the allotted span) as one by one his old friends vanished away. And it would be selfish of us to think only of our own loss, and to be unmindful of the joy there must have been in heaven when Tom entered in.

PROCEEDINGS OF THE COUNCIL IN MARCH

AT A MEETING of the Council on the 13th March, with Professor Sir James Paterson Ross, President, in the Chair, Professor Clarence Crafoord, Professor of Thoracic Surgery at Kungi Karolinska Mediko-Kirurgiska Institutet, Stockholm, 60, was admitted to the Honorary Fellowship of the College.

Mr. William Gissane, F.R.C.S., Surgeon-in-Chief, Birmingham Accident Hospital, was appointed a Sir Arthur Sims Commonwealth Travelling Professor to visit Australia in 1959.

The period of approved training in recognised hospital posts for candidates for the Fellowships in Otolaryngology and Ophthalmology has been extended from 18 months to two years.

It was decided to agree to the request of the University of Ceylon to hold Primary F.R.C.S. and Primary F.D.S. Examinations in Colombo in January, 1959.

The twenty-seventh Macloghlin Scholarship was awarded to David A. Warrell of Portsmouth Grammar School and a certificate of honourable mention to C. D. Lambert of Varndean Grammar School, Brighton.

Diplomas were granted as follows:

Membership (1); Fellowship in Dental Surgery (1); Licence in Dental Surgery (79); Diploma in Orthodontics (4).

PROCEEDINGS OF THE COUNCIL IN MARCH

The following hospitals were recognised under paragraph 23 of the Fellowship Regulations :

HOSPITALS	POSTS RECOGNISED		
	General (all 6 mths.)	Casualty (all 6 mths.)	Unspecified (all 6 mths.)
SALISBURY—Salisbury General Hospital (Additional)			Regr. (Orth.) S.H.O. (Orth.)
SOUTHAMPTON — Southampton Eye Hospital (Additional)			<i>Under para. 23 (b)</i> Regr. (Ophth.) S.H.O. (Ophth.)
WIGAN—Royal Albert Edward Infirmary (Continued)			<i>Until March 1959</i> <i>under para. 23(c)</i> Regr. (E.N.T.)
LONDON—Tilbury and Riverside General Hospital (Additional)			H.S. (Orth.) (pre-registration)
KINGSTON-ON-THAMES — Kingston County Hospital (Additional)		Cas. Regr.	
LONDON—Poplar Hospital (Redesignation)	<i>Redesignation</i> H.O. to S.H.O.		
AMERSHAM—Amersham General Hospital (Regrading)		<i>Regrading</i> of Pre-reg. H.S. as S.H.O. (Cas. & Orth.)	
KETTERING — Kettering and District Hospital (Additional)	Regr.		

RECENT OVERSEAS VISITORS TO THE COLLEGE

RECENT OVERSEAS VISITORS to the College have included Professor A. K. Basu, who delivered a Hunterian Lecture in the College in March, and Mrs. Basu from Calcutta.

MONTHLY DINNERS

MONTHLY DINNERS ARE held in the College on the Wednesday before the second Thursday of each month. The following are entitled to attend with their guests : all diplomates and students of the College and members of the Associations linked to the College through the Joint Secretariat. It is not necessarily intended that guests should be members of the medical profession.

The next two dinners will be held at 7 for 7.30 on 16th April and 7th May.

The cost is £1 10s. 0d., which includes cocktails before dinner and wine at the table. Applications for tickets, accompanied by a cheque for the appropriate amount, must be sent to the Deputy Secretary at least a week before the date of the dinner. Cheques should be made payable to " Royal College of Surgeons of England." The dress is lounge suit.

COURSE IN STATISTICS AND RADIO-ISOTOPES

5th to 9th May 1958

Monday

5th May, 10.00 a.m.	Mr. Hedley Atkins	Elementary nuclear physics.
11.30 a.m.	Prof. A. Bradford Hill	Clinical trials. Planning and design.

Tuesday

6th May, 10.00 a.m.	Prof. C. B. Allsopp	The biological effects of ionising radiation.
11.30 a.m.	Prof. A. Bradford Hill	Clinical trials. The collection and analysis of data.

Wednesday

7th May, 10.00 a.m.	Mr. D. G. Arnott	Radio-isotopes and diagnosis.
11.30 a.m.	Prof. A. Bradford Hill	Normality and variability.

Thursday

8th May, 10.00 a.m.	Dr. H. E. Pochin	Radio-isotopes and thyroid disease.
11.30 a.m.	Prof. A. Bradford Hill	Tests of significance.

Friday

9th May, 10.00 a.m.	Prof. D. W. Smithers	Radio-isotopes and therapy.
11.30 a.m.	Prof. A. Bradford Hill	Statistics in epidemiology.

The course is intended as an introduction to the two subjects and is suitable for candidates studying for higher qualifications and for research workers. Applicants will be required to pay a fee of two guineas for the course and applications should be forwarded to the Secretary, Institute of Basic Medical Sciences, Royal College of Surgeons of England.

ANATOMICAL MUSEUM

THE SPECIAL DISPLAY for the month of April consists of Hunterian specimens showing "products of generation."

DIARY FOR APRIL

Thur. 17	2.00	Quarterly Council.
	5.00	PROF. A. G. JESSIMAN—Hunterian Lecture—Hypophysectomy in the treatment of breast cancer.*
	6.15	PROF. C. A. WELLS—Prostatic obstruction.
Fri. 18		Last day for nomination of candidates for the Council.
	5.15	MR. R. GUY PULVERTAFT—Reconstructive surgery of the hand.
	6.30	MR. SELWYN TAYLOR—Radioactive isotopes as an adjunct to surgery.
Mon. 21		Last day for nomination of candidates (F.D.S.) for election to the Board of Faculty of Dental Surgery.
	5.15	MR. C. P. WILSON—Malignant disease of the superior maxilla.
	6.30	SIR CLEMENT PRICE THOMAS—Carcinoma of the bronchus.
Tues. 22	5.00	MR. I. P. TODD—Arris and Gale Lecture—The physiology of rectal sensation and its relationship to disease.*
	6.15	MR. RODNEY MAINGOT—Postoperative strictures of the bile ducts.

Wed. 23		Second L.D.S. Examination begins.
	5.15	MR. H. J. SEDDON—The surgery of poliomyelitis.
	6.30	MR. S. O. AYLETT—Ulcerative colitis.
Thur. 24		D.M.R.D. Examination (Part II) begins.
	5.15	MR. WYLIE McKISOCK—Surgical treatment of intracranial aneurysms.
	6.30	PROF. C. G. ROB—Arterial occlusion.
Fri. 25		Surgical Lectures and Clinical Conferences end.
	5.15	MR. N. R. BARRETT—Tumours of the chest wall.
	6.30	MR. VICTOR RIDDELL—Management of thyrotoxicosis.
Sat. 26		Last day for applicants for Lectureships.
Mon. 28		Dental Lectures and Clinical Conferences begin.
Tues. 29	5.00	MR. A. D. MARSTON—General anaesthesia—I.
	5.00	DR. H. G. H. RICHARDS—Erasmus Wilson Demonstration—Thrombosis and infarction.*
	6.15	MR. B. W. FICKLING—The maxillary antrum in relation to oral surgery.
		Final Fellowship Examination (Ophthalmology and Otolaryngology) begins.

DIARY FOR MAY

Thur. 1		D.M.R.T. Examination (Part II) begins.
	3.45	MISS J. DOBSON—Arnott Demonstration—John Hunter's Museum.*
	5.00	MR. A. D. MARSTON—General Anaesthesia—II.
	6.15	DR. W. CAMPBELL—Radiology of the facial bones.
Fri. 2		Basic Sciences Lectures and Demonstrations end.
Tues. 6		Final Fellowship Examination (General Surgery) begins.
		Names of candidates (F.D.S.) for election to the Board of Faculty of Dental Surgery announced.
		Date of election of Licentiate to the Board of Faculty of Dental Surgery announced.
	5.00	DR. ROCKE ROBINSON—Moynihan Lecture—Observations on wound infection.*
	5.00	PROF. R. B. LUCAS—Pathology of oral neoplasms—I.
	6.15	MR. PATRICK CLARKSON—Surgical correction of deformities of the jaws.
Wed. 7	7.30	Monthly Dinner.
Thur. 8	2.00	Ordinary Council.
	5.00	PROF. W. W. DAVEY—Hunterian Lecture—The surgery of anastomotic ulceration.*
	5.00	PROF. R. B. LUCAS—Pathology of oral neoplasms—II.
	6.15	SIR V. ZACHARY COPE—Actinomycosis.
Tues. 13	3.45	D.Path. Examination begins.
	5.00	DR. D. C. ROBERTS—Imperial Cancer Research Fund Lecture.*
	5.15	MR. B. E. D. COOKE—Fibro-osseous swelling of the jaws—I.
	6.15	Imperial Cancer Research Fund Council.
Thur. 15	4.30	MR. S. H. WASS—Osteomyelitis of the jaws.
	5.00	D.A. Examination begins.
	6.15	MR. B. E. D. COOKE—Fibro-osseous swelling of the jaws—II.
	6.15	DR. M. J. F. McARDLE—Facial pain.
Fri. 16	5.00	Board of Faculty of Dental Surgery.
Tues. 20	5.00	MR. C. R. McLAUGHLIN—The cleft palate.
	6.15	DR. L. FORMAN—Oral manifestations of skin diseases—I.
Thur. 22	5.00	MR. B. COHEN—Secondary tumours of the jaws.
	6.15	DR. L. FORMAN—Oral manifestations of skin diseases—II.
Sat. 24		College closed.
Mon. 26		WHIT MONDAY. College closed.
		Last day for nomination of candidates (L.D.S.) for election to the Board of Faculty of Dental Surgery.
Tues. 27	5.00	DR. J. C. HOUSTON—Blood diseases in relation to dentistry.
	6.15	MR. G. T. HANKEY—Disorders of the mandibular joint.
Wed. 28		Primary F.R.C.S. Examination begins.
Thur. 29	5.00	PROF. M. A. RUSHTON—Lesions of the lips.
	6.15	MR. A. M. A. MOORE—Soft tissue infections of the face and neck.

*Not part of courses.



5

AN ENTERPRISE IN DENTAL RESEARCH

Webb-Johnson Lecture delivered at the Royal College of Surgeons of England

on

22nd November 1957

by

Sir Wilfred Fish, C.B.E., M.D., D.Sc., F.D.S.R.C.S.Eng.

Honorary Director, Department of Dental Science,
Royal College of Surgeons of England

DEDICATION

THE WEBB-JOHNSON Commemoration Lecture was instituted to pay tribute to the man under whose leadership the Faculties were established and who presided over the rehabilitation of the College after the heavy damage sustained during the raids on London. I am greatly honoured in being permitted to deliver the third lecture of the series; and though we are sad that this dreary weather is keeping Lord Webb-Johnson a virtual prisoner in his house to-day, we have sent him a message of greeting and he has sent us his good wishes graciously conveyed to us here by Lady Webb-Johnson herself.

Lord Webb-Johnson's Presidency was not only the beginning of a new era in the life of the Royal College of Surgeons but it marked a new epoch in the relationship of our profession to the college and provided new opportunities for the development of dental science and practice. It seems therefore appropriate to introduce what I have to say about the establishment of dental research in the college by a short review of the foundation of the Faculty against the background of Lord Webb-Johnson's wide contribution to the progress of surgery in general.

G. K. Chesterton, in one of his delightful essays, reminds us that "There are two equal and eternal ways of looking at this twilight world of ours; we may see it as the twilight of evening or the twilight of morning; we may think of anything, down to a fallen acorn, as a descendant or as an ancestor."

We may so regard Lord Webb-Johnson. No one in our time has shown a more lively appreciation of the great traditions we have inherited in this College; nor is there any more absorbing account of the history of English surgery in the making than the Syme Oration delivered by him in Melbourne before the Royal Australasian College of Surgeons in March 1939. It is his great delight, as one of the Hunterian Trustees, to recall the history of the Museum or to talk about the great surgeons of the past, and no one who served on the first Board of Faculty will ever forget the pleasure of listening to his stories after dinner in the old Council Room, where the scars of battle on the walls of the chamber were only partly hidden by some of the most treasured pictures of the College.

We, however, are able to appreciate him from Chesterton's other point of view as one who has made history and been a chief actor in the exploits that future generations of surgeons will recount. Our own descendants in

SIR WILFRED FISH

particular will recall that it was in the sixth year of his Presidency that the Faculties were founded; but they will also remember the wider spread of his activities that have influenced the development of surgical practice throughout the commonwealth for nearly half a century.



*(Portrait by Francis Hodge from the Middlesex Hospital Collection.
Reproduced by kind permission of the Middlesex Hospital.)*

The Rt. Hon. Lord Webb-Johnson of Stoke-on-Trent, G.C.V.O., C.B.E., D.S.O.,
T.D., F.R.C.S.

First as Dean of the Middlesex, then as President of this College, and next as President of the Royal Society of Medicine, he either rebuilt or

enlarged each institution. We remember with pleasure that it was he who received the delegates of the XIth International Dental Congress at the Royal Society of Medicine in 1952. More recently on the 13th June we had the great satisfaction of seeing him himself admitted to the newly established Court of Patrons of this College. The Court was established to "consist of individual men and women elected by the Council in recognition of their outstanding services to the College." No citation could more aptly describe Lord Webb-Johnson and indeed it is impossible to refer to that happy occasion without remembering also the other gracious ceremony when the very first member of the Court of Patrons, Lady Webb-Johnson, was admitted on the 19th December, 1956, to commemorate the foundation by her of the McRae-Webb-Johnson Fund for the maintenance of the Hunterian Collection.

There seems to have been a dual purpose directing all Lord Webb-Johnson's great contributions to medicine and surgery and I like to think that this twofold aim may be reflected in the design of the Faculties, making possible the enterprise in dental research which is now being embarked upon here in the College. The first objective was that surgery should be securely founded on the basic sciences as a whole and especially on pathology, perhaps even more tenaciously than on anatomy. The second was that not only this College as the home of surgery but also the great teaching hospitals and indeed any foundation associated with medicine or surgery, should present the outward and visible sign of their importance in the life of the nation. He has always contrived that the institutions with which he was concerned should be suitably housed in dignified buildings which were well adapted to their purpose, reflected their great traditions and provided an inspiring environment in which the rising generation could conveniently pursue their studies.

To these two principles may perhaps be added a third; it was his determination that all branches of surgery should be represented within this College. The importance of this purpose to our own Faculty can hardly be exaggerated, and it may be observed that this encouragement of surgical specialties was a very early interest. When the 1914-1918 war broke out Lord Webb-Johnson was already on the staff of the Middlesex and like most other surgeons in those days he went to France. It was there, as the surgical consultant to the Bologne area, to which before very long he was appointed, that he was able to give expression to his belief in the value of specialisation. For example, he sent all the neurological cases down to specialists and later on at the Middlesex this trend was further developed when he sponsored the establishment of the Orthopaedic Department which was developed by A. S. Blundell-Bankart. Lord Webb-Johnson himself developed the Department of Urology and it is no doubt a very fortunate thing for this Faculty that he did adopt these decided views on specialisation and that his sympathies were enlisted.

SIR WILFRED FISH

Similarly much of his work at the Middlesex indicates the importance he attached to the basic sciences as an introduction to surgery. He arranged, for instance, that the Medical School should become a school of the university, a move that not only attracted grants from the University Grants Committee but also involved the establishment of chairs in physics, anatomy, and physiology, for which he secured endowments. He was closely concerned with the building and endowment of the Courtauld Institute of Biochemistry and here both his interest in the basic sciences and his determination that everything pertaining to the education of a surgeon should be suitably housed, found expression; just as the building which is rising outside the doors of this hall and which is a part of his original plan for our Faculty, will provide inspiring accommodation for the Department of Dental Science.

The beginning of the Faculties

Many present to-day will know the story of the origin of the Faculties in the College but it seems to be appropriate to put it briefly on record for those who do not.

In January of 1939 the Board of Examiners put forward a recommendation that a Fellowship in Dental Surgery should be instituted. This would have involved a change in the Charter and was therefore referred to a committee under the Chairmanship of Wilfred Trotter. The committee did not agree with this proposal but did recommend that a diploma of "Master Surgeon Dentist of the Royal College of Surgeons" should be established, and on 31st July, 1939 this recommendation was approved by the Council.

The War intervened, however, and the whole project was dropped, until one night in September 1941 Sir Henry Souttar went round from his flat in Harley House to 70 Portland Place to talk the matter over with the President. A heavy air-raid developed so that he had to stay until it was over; and it was during that time that the idea of the Faculties was evolved. Lord Webb-Johnson says it was Sir Henry's inspiration, Sir Henry that the credit should go to Lord Webb-Johnson who at any rate determined there and then to give effect to the proposal and combine with it his own purpose to set up the Fellowship in Dental Surgery.

The question was accordingly revived and referred to the Charter Committee in 1943. In 1944 our first Dean of Faculty was invited to attend Council meetings, and the following year became a co-opted member of Council. Meanwhile the College had suffered serious damage in the blitz which caused further delay; but whereas in those turbulent times most peaceful institutions were put into neutral, especially if they had suffered in the air-raids, hoping they would somehow manage to survive, this College, though it had been heavily burnt, did nothing of the kind. Led by their President, whose many friends provided the money, they bought the property that had been laid waste all round and drew up their plans for rebuilding the College on a much more ambitious scale.

The moment was therefore propitious for founding the Faculties since they could be accommodated in the new buildings that were being planned. Nevertheless it took four years and needed a new Charter and numerous memoranda before this Faculty and the Fellowship in Dental Surgery were established. A few months ago Sir Henry Souttar gave me a memorandum which he wrote in 1947 and which Mr. Le Fanu has kindly promised to preserve. It opens, as any document should, with an important and arresting pronouncement: "It is our agreed policy" it reads "that we should endeavour to keep within the College all special branches of surgery and to protect their academic interests in every way as distinct but associated portions of one art."

And so in 1947 the Faculty was established at a moment when in the course of natural evolution and growth there was a danger that the administrative separation of Dentistry from Surgery and Medicine, which had become a legislative necessity, might lead to complete disruption of an association by which for nearly a hundred years Dentistry had profited from her parent profession both by precept and example. It may well be that forging this close link between dentistry and the other surgical sciences in the College will prevent any such disaster and that the next hundred years, instead of witnessing the separation of medicine and dentistry in this country, will see a closer bond and a great development of dental surgery, relieved of much of its drudgery, as a major branch of surgery and preventive medicine.

There have certainly been more immediate benefits too of a most encouraging kind. Under our first Dean, Professor Bradlaw, representatives from all branches of the profession were brought together in the first Board of Faculty, and designed the new examinations. Meanwhile two hundred and fifty dental surgeons were nominated for election to the Fellowship, and post-graduate courses in the basic sciences were arranged for the younger dental surgeons who wished to submit themselves for examination. In this way those who were undergoing the new discipline of consultant training in dentistry could aspire to Fellowship of the College just as do their medical colleagues.

The timing once again was particularly fortunate. The clinical training of registrars to become consultants in dentistry was being developed within the Post-graduate Medical Federation of the University of London, first under the direction of Sir William Kelsey Fry and now of Professor Wilkinson, our second and third Deans. At the same time more consultant posts were about to be established as part of the National Health Service. It all fitted together perfectly to the great benefit of British dentistry.

Establishing the Department

At length in 1953 these arrangements were running smoothly and the new building, in which the Faculty had been allotted the first floor, was about to materialize. The Board were accordingly requested to make

their plans for using the space to be put at their disposal and to lay them before the Council. The decision was of course to provide new quarters for the Odontological Museum and to establish a research unit to be called the Department of Dental Science.

Much money had to be found and many good friends of the College and of the Faculty provided it. The scientific staff had to be looked for well in advance, and subsequent delay in the building programme presented its own problems. At length however towards the end of last summer we were established in temporary laboratories, some of which were our own and some were borrowed from other departments. The team working in this unit have as their assignment research related to the prevention of dental disease and in carrying out this work it is intended that they shall have at their disposal such recent advances in scientific method and technique as may be applicable. In addition they are themselves to select and train junior fellows in research method.

This latter assignment inevitably raises the question of the kind of attributes one would expect to find in a research worker and that one would therefore hope to discover in embryo in a candidate for training. Perhaps one may digress for a moment and consider these, since such reflections could also be helpful in deciding what training the recruit should receive. Obviously he should have had a good grounding in the basic sciences. He must also have a logical mind capable of formulating a problem clearly and concisely. Perhaps too it will be agreed that an instinctive ability to select and remember things that are important, and reject those that are irrelevant is a reliable test of intelligence.

Training in research method, however, can only be gained by experience, and skill in analysing a problem in order to limit and concentrate the field of enquiry and avoid waste of effort will increase with practice. The importance of excluding variables and using adequate controls will also be learnt as the work proceeds; but unless this pattern of thought comes naturally to a man it may take a long time to acquire to say the least of it.

A study of the characteristics of those who have consistently made important contributions to knowledge suggests, however, that there are also other qualities. For instance, they have all seemed to experience a compelling curiosity, and they all were possessed of tremendous enthusiasm. Curiosity in research is an indication of scientific perception and the man who says he wants to do research but does not know what he wants to find out, will always be pedestrian—unless he can be persuaded to take up something else. Those who have been most successful in research have usually complained that there was too much to explore and too little time to do it in.

As to enthusiasm, one may quote from Dubos' story of Louis Pasteur. Pasteur was an old man at St. Cloud dreaming dreams and reflecting on the visions of his youth: "The Greeks," he said, "have given us one of the most beautiful words of our language, the word 'enthusiasm'—a

god within. The grandeur of the acts of men is measured by the inspiration from which they spring. Happy is he who bears a god within ! " That is a quality that every research worker needs—enthusiasm—to be possessed by the god, to be endowed with a perpetual source of inspiration.

Nevertheless, even by adding a thirst for new knowledge and boundless enthusiasm to these other basic qualifications for research one still does not arrive at originality, which may perhaps be described as creative imagination or as Alexander Wood says, speaking of Rutherford, " a kind of instinctive insight." It may certainly be regarded as the quality that is to research what charity is to the Pauline philosophy and without which all the rest profiteth nothing.

It is sometimes said, a little obscurely, that to be original one must go back to the old masters. This cannot mean imitation for that of course is the very antithesis of originality ; but where the old masters can be most helpful is in showing with what selective insight they explored their problems and brought together the significant facts, excluding those that were irrelevant and often including some that other workers had overlooked. It is particularly instructive to observe how they contrived to simplify the matter at issue and to state it clearly and in a way wholly directed towards providing a solution ; and finally to observe how they designed a no less simple and direct experiment to put the issue to the test. If one enquires further how they did this the answer is probably that they could do it because they *were* masters, masters of their subject ; because, that is, they had lived for it and in it, and because they had become completely absorbed by it ; because they had a god within. In the difficult task we have undertaken we shall have need of all the inspiration and instruction we can get, and perhaps I may refer to some of the problems that arise.

A systematic approach to prevention

The avowed purpose of the undertaking is, as I have said, to explore the possibilities of preventing dental disease, a remarkably wide assignment ; but on analysis it may be possible to break it down. The two most prevalent dental diseases are caries and parodontal disease. There are also other diseases of the teeth and their associated tissues that merit investigation and have not been overlooked, but these two are so prevalent and so devastating that they may be given priority ; and as there is only time on this occasion to focus attention on one, let that one be parodontal disease. Curiously enough, the preliminary work we have done, to enable us to decide on a line of approach, has led us to believe that the two problems have something in common.

The first thing, perhaps, is to define what is meant by " Parodontal Disease." One would not wish to take part in the controversy that rages round questions of nomenclature and classification of parodontal or periodontal disease, but if one is seeking a means of prevention it would

seem necessary to define what it is that one is seeking to prevent. Let it therefore be said that the discussion which follows relates to the syndrome which is commonly observed at some stage or other of its progress, and in some part of the mouth, in the great majority of those adults in a civilized community who have contrived to keep their natural teeth. It is a syndrome which leads ultimately to the destruction of the periodontal fibres and deep resorption of the supporting bone. Finally the teeth loosen and fall out.

As for nomenclature, (but may I say, completely without prejudice) the word "parodontal" will be used to denote "near to" or "by the side of" the tooth, for instance, a "parodontal ulcer," and the word "periodontal" will be used to mean "around" the tooth, for example, the "periodontal membrane."

Once questions of nomenclature and definition are disposed of, two other preliminary matters present themselves for immediate consideration. The first is whether the parodontal syndrome is to be regarded as a constitutional disease with local manifestations or as one of entirely local origin; and the second question is how does the disease start?

To take first the question of whether it is a constitutional disease or one of local origin, there are arguments in favour of both opinions. For instance, the fact that it responds to local treatment so rapidly and so consistently makes it difficult to believe that it is not the result of local irritation; indeed a local form of the disease can all too easily be produced round a single tooth in response to direct irritation, for example by a badly fitting crown. Moreover in people with quite active generalised pyorrhoea the corresponding tissues in other parts of the body are not affected. The mucous membranes, bone and fibrous tissue elsewhere seem to be normal.

Conversely, every clinician is convinced that some people are abnormally susceptible to parodontal breakdown. In such people the disease appears in early life, it progresses rapidly, and even if treated it tends to relapse. This marked difference in susceptibility can hardly be due to some unrecognised factor in the local environment of the teeth and gums.

It need not be assumed, however, that these two propositions are mutually exclusive. It is quite reasonable to accept as a working hypothesis that the disease is a direct response to local irritation but that there are constitutional factors which make some people more prone to its onset than others and that these same factors, or perhaps others, make them less resistant to its progress and more liable to a recurrence. Indeed this is a very convenient approach, for it divides the research enterprise into two clearly defined spheres of activity. One involves close examination of local lesions and of the sequence of events in the progressive breakdown of the periodontal tissues, which is clearly our own business as dentists. The other involves instituting a much more fundamental investigation

of constitutional factors which do not lie specifically and exclusively within the dental field, for example bacterial resistance and the constitution of the collagenous structures of the body. Here we join forces with, and may hope to have something to contribute to, the general body of biological research.

The first and less involved field, the analysis of the sequence of events in the breakdown of the tooth attachment, raises the second question, namely how does the disease start? What is the first local lesion, the first deviation from normality, the first indication that parodontal disease is about to become established? It is of course a very important question, for obviously it is too late for prevention once the disease has become established. It is therefore all the more curious that there seems to be so very little unanimity on this point and despite persistent questioning, even amongst people of international repute, it has not been possible to get a consistent or even any very definite answer. Nevertheless, if one hopes to prevent the disease it is necessary not only to know how it starts but to prevent that first lesion.

There appear to be two ways in which one could explore this quite fundamental matter. One is to examine very young material, both human and comparative, in the laboratory, and the other is to institute a clinical survey and examine a large number of patients who are either free from parodontal disease or who exhibit only the earliest lesions. The difficulty about the laboratory approach is to get healthy or almost healthy young human periodontal tissue. This would of course be the best material to use and fortunately a certain amount of it is available and is being prepared for investigation. Meanwhile in the few months that have elapsed since the laboratory was opened, an examination of the periodontal tissue of young rats and monkeys has proved to be a useful introduction to this study of prevention and will be referred to in a moment in some detail as indicating the matters on which attention will be concentrated for some time to come.

At the same time we have been most fortunate in securing the interest and co-operation of our colleagues in the Royal Army Dental Corps; and the Director, General Muir, has kindly arranged for his officers to carry out a clinical survey of young cadets in order to see if it is possible to recognise any particular lesion as consistently being the first to appear. Perhaps it ought to be emphasized that the purpose of this clinical survey is not to discover the cause of the initial lesion but merely to identify and define it, both as to its nature and its position.

The great advantage of the clinical survey in support of the laboratory research is that a very much greater amount of material can be examined, all of which is human material, so that if the first lesion is not always the same there is every hope of that fact being recorded; and of course it also checks any serious distortion that might otherwise arise from the use of comparative material in the laboratory. On the other hand, the

advantage of the histological approach is that it enables the earliest deviations from normal to be recognised and provides additional information about the pathology of lesions observed clinically, with perhaps some indication of the aetiology.

It may of course be argued that there is no way of defining normality in respect of the periodontal tissues and therefore no way of recognising the first departure therefrom, since a state of affairs which is quite normal at one age would be anything but normal at another. For instance, it may be agreed that the epithelial attachment of the tooth should extend right up to the contact point in a young adolescent; but an interdental space soon develops and it must be very exceptional indeed for the epithelium to remain attached up to the contact point until adult life is reached. Yet this is not a sign of impending parodontal breakdown, and provided that there is no ulceration of the gum margin, no bone resorption, and little more deepening of the parodontal sulcus mesially or distally than is normally found on the buccal or lingual aspects of the teeth, there would be no reason to suggest that the arrangement of the tissues was in any way abnormal or that the patient was suffering from incipient parodontal disease. However it is hoped to avoid the complications that might arise out of age changes in clinical subjects by restricting the survey to one age group, namely adolescents.

On the other hand, the only way to start the histological investigation is obviously to review such human material as can be made available from any age group. Some years ago one recorded the clinical observation that young people who complained of bleeding when brushing the teeth, often displayed an ulcer at the tip of the interdental papilla. This ulcer gradually burrowed down into the papilla and split it mesio-distally into two—that is, into a buccal and a lingual portion (Fish, 1944, pp. 91, 92). Often enough this was the only lesion to be observed in an otherwise healthy mouth, but as time went on the interdental ulcer not only burrowed down more deeply into the interdental space and caused resorption of the tip of the bony alveolar crest but it also gradually spread round the tooth from the interdental area on to the buccal and lingual gum margin.

This clinical observation was supported, indeed it was prompted, by histological examination of such human periodontal material as became available from the post-mortem room, and that same material has proved most useful in orientating this new search for a means of prevention.

The interdental ulcer

The chronic interdental ulcer, known to clinicians in its later stages as a pyorrhoea pocket, has often been examined and described histologically. It can therefore be used as a convenient starting point from which either the earlier phases can be traced back to the perfectly healthy interdental papilla; or alternatively the later progressive phases of the lesion can be followed right on until massive destruction of the supporting tissues and

exfoliation of the tooth supervenes. In the years between the wars it was by studying this progressive breakdown, step by step, that methods of arrest and cure were elaborated, and it is hoped that by working backwards in the other direction it may be possible to discover how the breakdown of these tissues starts, and that thereby a means of prevention will emerge.

It is convenient to start therefore from the point where an interdental ulcer has become well established. At that stage the lesion may be found to have destroyed both the underlying trans-septal fibres and many of the periodontal ones too, as well as a part of the bony septum between the teeth. The base of the ulcer will be a typical mass of granulation tissue with aberrant epithelium proliferating within it and over its surface. The epithelial attachment has usually grown down leaving the cementum denuded or it may even have been completely destroyed (Fish, 1944, Fig. 68).

The lateral spread of this type of interdental ulcer round on to the buccal and lingual aspects of the gum margin has also often been illustrated histologically (Fish, 1944, Fig. 62); but it is unusual to find such severe destruction in these situations as is observed between the teeth. Indeed buccally and lingually the epithelium may be still attached at the amelo-cement junction and the bone hardly resorbed at all; although there will of course be an ulcer at the bottom of the deepened sulcus which will have destroyed the free marginal fibres and perhaps a few of the periodontal ones too. The fibres will have been replaced by round cells, but altogether the histological findings support the clinical observation that the earliest and worst lesions are to be found between the teeth and that the ulceration spreads round from these on to the buccal and lingual aspects.

It was therefore thought logical to inaugurate the search for a beginning by concentrating on the interdental space, and to try to obtain a series of specimens of the interdental ulcer each less severe than its predecessor.

The first section (Fig. 1) is of a moderately early human interdental ulcer. On the cadaver, a male aged forty-four, the interdental papillae appeared normal in structure and outline, although it is likely that a clinical examination during life might have revealed signs of the damage which is so evident at a microscopic level. Ulceration had occurred at the tip of the papilla and the underlying connective tissue was heavily infiltrated by leucocytes and lymphocytes. The trans-septal ligament was being invaded by round cells; the orderly arrangement of its fibres had already been disrupted and there was evidence of fatty replacement. It is clear that the insidious process by which the attachment of the teeth becomes disorganised was already under way, although the bony crest showed only the very earliest signs of resorption and there had not at the time of death been any appreciable downgrowth of the epithelial attachment.



Fig. 1. Photomicrograph $\times 60$. Interdental papilla [45]. Human, male, aged forty-four.

It is therefore necessary to seek still earlier lesions and these have been found in the monkey. Figure 2 shows an interdental ulcer probably of shorter duration than the human example, so that it had not caused so much destruction of the underlying tissue. The epithelium is completely disrupted at the centre of the lesion, that is, at the tip of the interdental papilla, and there is a heavy round celled infiltration replacing most of the connective tissue cells beneath it. The epithelial attachment to the enamel is however normal and does not extend downwards beyond the amelo-cement junction. The trans-septal fibres are intact except for

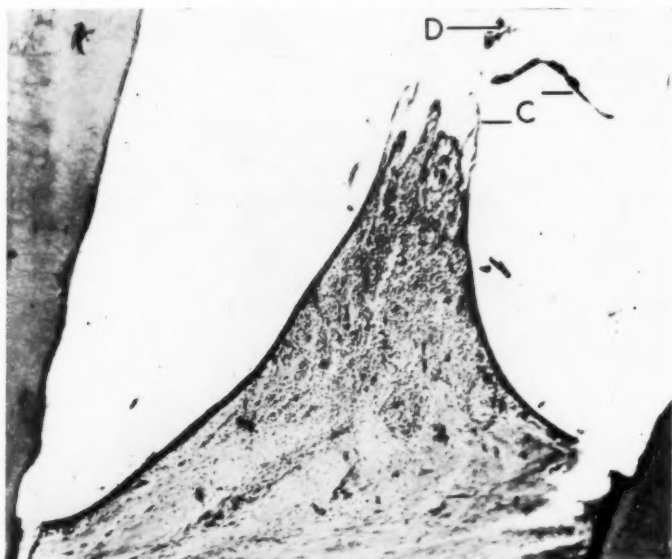


Fig. 2. Photomicrograph $\times 75$. Interdental papilla, molar region, monkey. D = Debris invaded by polymorphonuclear leucocytes. C = enamel cuticle of adjoining tooth.

artefact, and so is the underlying bone. There was no bone resorption and no loss of those periodontal fibres by which the tooth was secured to the bone. This is obviously the same kind of lesion as that shown in Figure 1, but so far all that had happened was that there had been a breach of the surface epithelium permitting contamination of the subjacent tissue. This provoked a round celled infiltration, with a few polymorphonuclear leucocytes at the actual breach. Extending beyond the tip of the papilla are the remnants of the enamel cuticles (C) of the adjacent teeth. A few polymorphonuclear leucocytes are to be seen attached to these remnants and to a fragment of debris (D) lying in what must have been the developing interdental space. Other leucocytes were emerging from a capillary (L) Fig. 3) near the damaged tip of the papilla.

In the subsequent sections the amount of tissue destruction gets progressively less so that there is no need to mention again that the deeper structures, the bone, the periodontal fibres and indeed the attachment of the epithelium at the amelo-cement junction are not in any of them affected; but it is an important observation that histologically, bone changes do not appear to precede ulceration.

The next section (Fig. 4) is also from a monkey. In this case there is no actual breach of the epithelium which still covers the surface of the

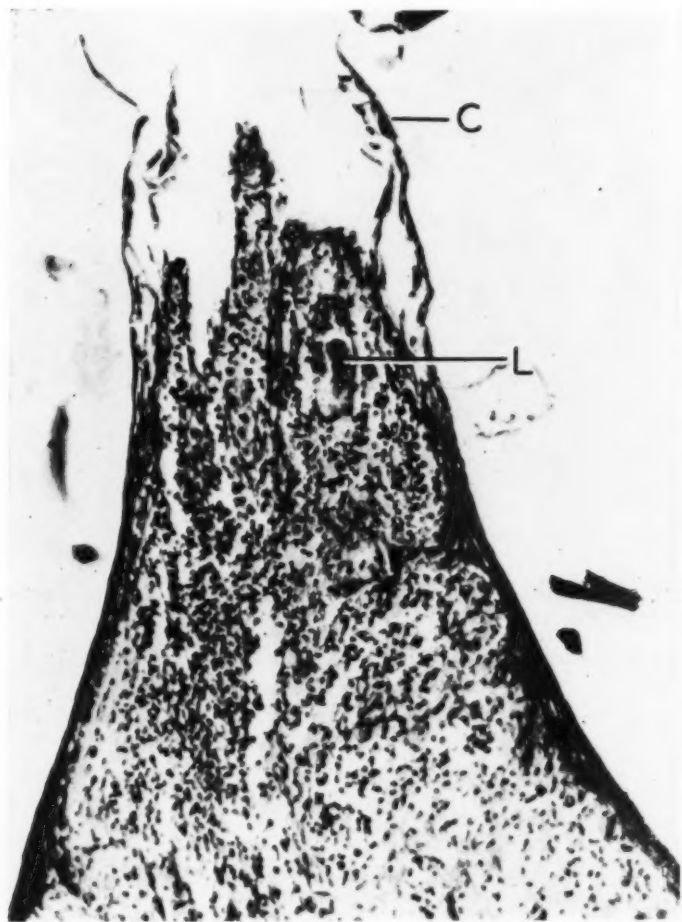


Fig. 3. Photomicrograph $\times 250$. Higher magnification of Figure 2 to show capillary (L), and cuticle (C).

interdental papilla, although it is not intact. The keratinous cuticle was no doubt disintegrating at the tip and part of it has come adrift completely in preparing the section. The remnants are observed as two detached curved fragments above the papilla. The rest of the cuticle is still in place on the sides of the papilla (C) Fig. 5), where it acted as the cementing substance attaching the papilla to the enamel, which latter has of course disappeared in preparing the section.

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Despite the protection of several layers of epithelial cells at the tip of the papilla there was already a very marked round celled infiltration of the connective tissue down to the trans-septal ligament. Nevertheless this seems to be a slightly earlier stage of the ulcer than that seen in the last section, having been caught just before a complete breach in the epithelium

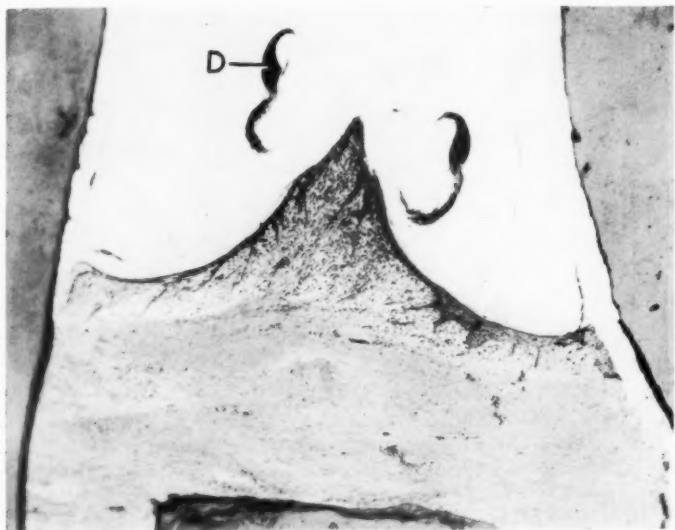


Fig. 4. Photomicrograph $\times 65$. Interdental papilla, molar region, monkey.
D = Detached remnant of enamel cuticle with debris adherent to it.

occurred. It is also probably an earlier stage than any that could be detected clinically in the human subject.

It is however possible to find still earlier lesions in the interdental papilla of the rat. Before leaving this section however it should be noticed that here also there is some infected debris ((D) Fig. 5) firmly adherent to the detached remnants of the cuticle and invaded by polymorphonuclear leucocytes ((P) Fig. 5). This observation may be important in relating this lesion in a primate with those that are about to be described in the rat.

Figure 6 shows a section of the interdental papilla between the molars of a rat and indeed it does not appear morphologically to be very different from that of the monkey. The remnants of the enamel cuticles of the two adjacent teeth can be observed at a little distance from the tip of the papilla; they were detached from it in preparing the section. They too have debris adhering to them which has been invaded by a cluster of polymorphonuclear leucocytes (P). There is a complete breach in the

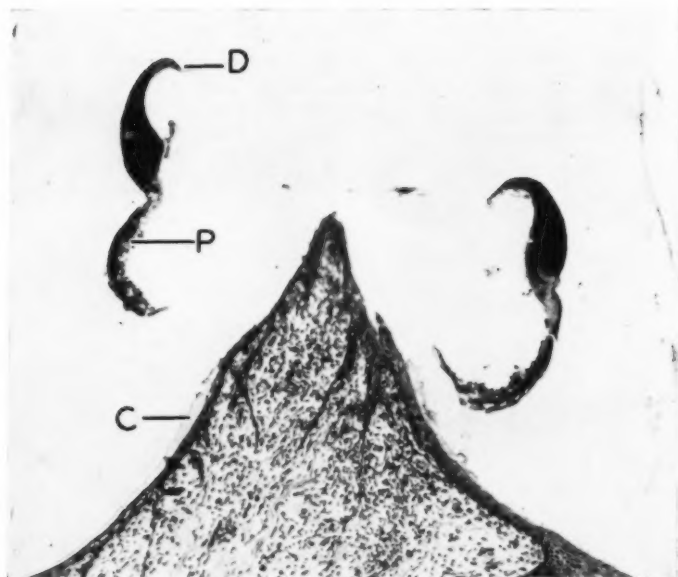


Fig. 5. Photomicrograph $\times 125$. Higher magnification of Figure 4 to show enamel cuticle (C) still attached to the papilla. A detached portion of the enamel cuticle (D), with debris adherent to it, invaded by polymorphonuclear leucocytes (P).

epithelium at the tip of the papilla, and moreover the cellular infiltration of the subjacent connective tissue consists almost entirely of polymorphonuclear leucocytes. They are there because there is a solid mass of infected debris (D) actually filling the breach in the epithelium, and lying in direct contact with the leucocytes. The lesion might be described as a small, very localised, sub-acute ulcer.

The next section (Figs. 7 and 8), also from the interdental papilla of a rat, is almost entirely free from any pathological reaction. The papilla does however exhibit a rather remarkable phenomenon for it seems to be little more than a connective tissue pathway leading up between the layers of enamel epithelium which were still adherent to the two adjacent teeth. This funnel shaped area is not sealed at its tip under the contact point with a keratinised layer of epithelium but is closed by a little cluster of polymorphonuclear leucocytes (P) (Figs. 7 and 8).

The connective tissue of the papilla is free from cellular infiltration except that just under the basal epithelial cells towards the tip there were a few polymorphonuclear leucocytes making their way along the funnel-like corridor to join those which had already congregated just

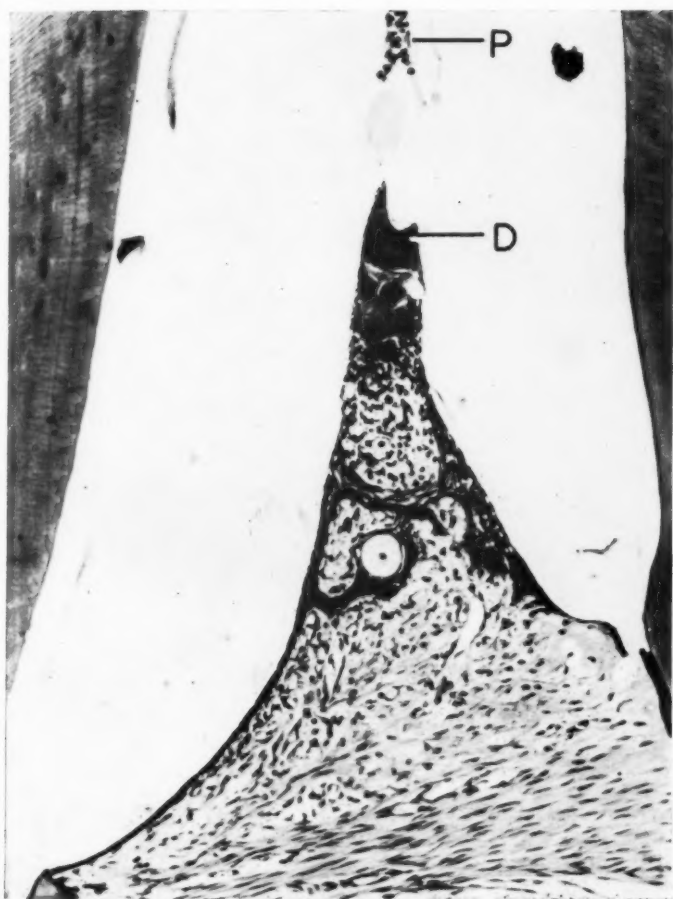


Fig. 6. Photomicrograph $\times 200$. Interdent papilla, molar region, rat. P = Polymorphonuclear leucocytes invading debris lying between detached remnants of the enamel cuticles of the adjoining teeth. D = Debris lying in the breach where epithelium is missing at the tip of the papilla.

below the contact point. Whatever incident caused this reaction therefore had only recently occurred.

References to sections of the interdent papillae of still younger rats (Fig. 9) suggests that when the teeth first erupt the actual tip of the papilla may merely be sealed off by the union of the enamel cuticles of the two adjacent teeth, though this is not yet completely established. Nor is it

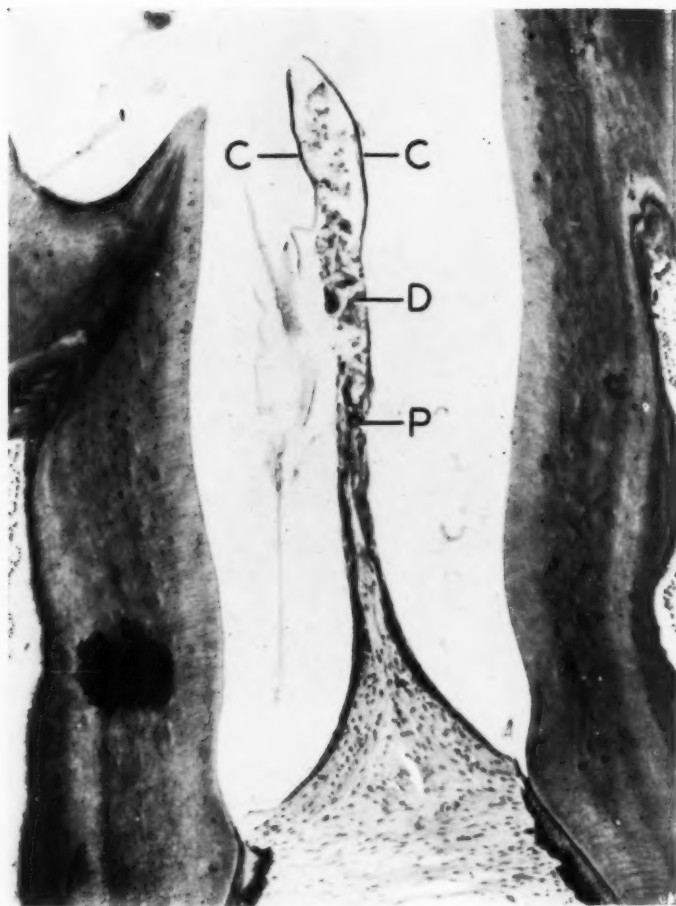


Fig. 7. Photomicrograph $\times 110$. Interdental papilla, molar region, rat. The pathway leading from the connective tissue of the papilla to the interdental space between the enamel cuticles (C) is filled with a small cluster of polymorphonuclear leucocytes (P). D = infected debris invaded by leucocytes.

clear whether the breach that appears in Figures 7 and 8 is traumatic, having been caused by the independent movement of one tooth on the other, or whether it was opened up or perhaps prevented from closing by bacterial attack, but it would seem to be very important to find out.

Meanwhile whatever caused this breach at the tip of the papilla the leucocytes were clearly attracted to it by the infected debris lying in the

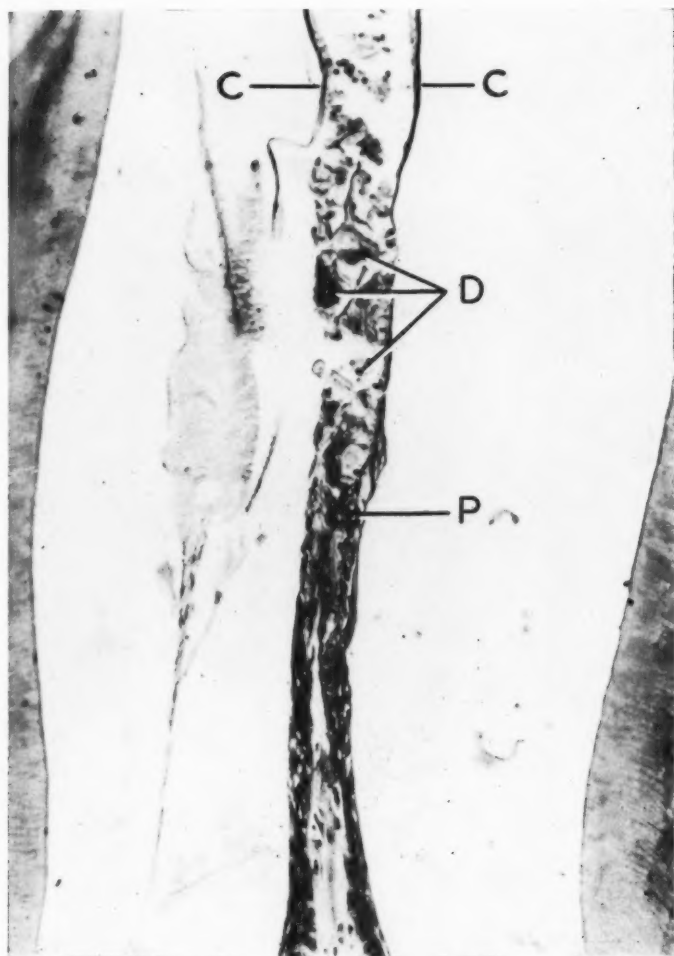


Fig. 8. Photomicrograph $\times 200$. Higher magnification of Figure 7.

developing interdental space and adherent to the enamel cuticles of the two adjacent teeth (Fig. 8). These small masses of debris resemble bacterial plaques, indeed they may be quite indistinguishable from them, and examples such as that in Figure 10 were actually being examined by my colleague Mr. Stewart Ross at the Hampton Hale Laboratory over



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Fig. 9. Photomicrograph $\times 60$. Interdental papilla of rat sealed at the tip by apparent fusion of the enamel cuticles of the adjoining teeth.

(c.p. Fish 1944, fig. 58)

twenty years ago in connection with an investigation into the early signs of caries.

A curious situation therefore arises for it has been found possible to trace the origin of the interdental ulcer in the rat to a lesion involving only a few score of leucocytes that are emerging through a breach in the epithelium at the tip of the interdental papilla. That might perhaps have been expected, but it was certainly not anticipated that the leucocytes should be there in response to bacteria that not only appear to be threatening to invade the papilla but are also forming a bacterial plaque of some kind on the keratinous cuticles of the interproximal enamel. It is difficult not to draw the conclusion that these bacterial plaques on the

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enamel cuticles are much the same as the plaques which Leon Williams and many other observers since his time have described as the first stage in the onset of caries. It appears therefore that this same point might have been reached, indeed was reached, many years ago, by tracing back interdental caries rather than parodontal disease to its first deviation from complete normality. Perhaps this meeting of the ways might have been described earlier, and in human material, if it had been common

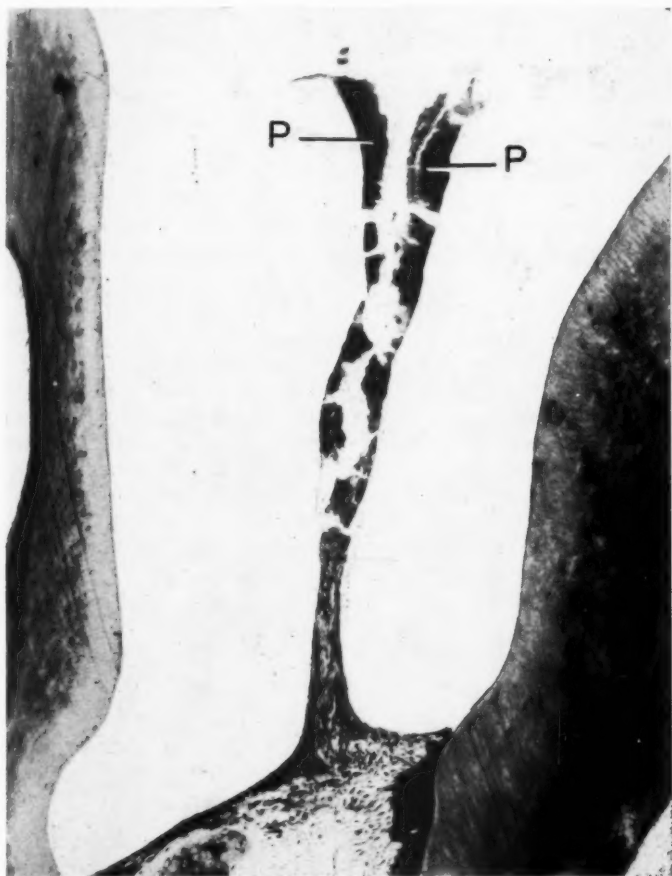


Fig. 10. Photomicrograph $\times 125$. Interdental papilla of rat, molar region. There is a mass of infected debris resembling a dental plaque (P) on the enamel cuticles of the adjoining teeth.

practice to section teeth *in situ* in the course of investigating caries as it is when investigating parodontal disease.

One must not of course digress unduly, but the prevention of caries is just as much an assignment of the new department as the prevention of parodontal disease. It was one of the earliest, if not the very first, observation to be recorded in relation to the onset of caries that the disease occurs in what are called the stagnation areas of the teeth, that is, in the fissures and below the contact points. It may however be significant and even very important that it is in precisely these areas that keratinous remnants remain on the surface of the enamel. This makes one reflect whether in fact the presence of keratin as a substrate, or at least as a foothold for bacteria of one kind or another, is not an essential prerequisite to the destruction of the enamel by acidogenic organisms. In this connection the work of Manley and Hardwick, who found the enamel lamellae always infected whether the inorganic fraction of the enamel was attacked or not, may assume crucial significance.

Meanwhile, to revert to the development of the interdental ulcer in the rat, it occurs at the point where the cuticles of the adjoining teeth appear to coalesce at the contact point (Fig. 9) thereby precariously sealing off the tip of the papilla, at least for the moment. It would seem that in the bacterial disintegration or in the rupture of this minute keratinous wedge, there is a phenomenon common to the earliest manifestation of both interproximal caries and parodontal breakdown.

Whether this small vulnerable wedge of keratin is derived in part from the epithelium of the papilla, if indeed the papillary epithelium exists as a separate entity, or is derived entirely from these remnants of the enamel organ that constitute the epithelial attachment of the adjoining teeth, has still to be determined. It will also be realised, of course, that one has only traced the interdental ulcer back to its origin in the rat, and that the human interdental papilla must be explored histologically in the young subject before definite conclusions can be drawn. Moreover it is still necessary to await the result of the clinical survey to see if there are other ways in which parodontal breakdown can be initiated—and much more besides remains to be done. It was, however, the whole purpose of this investigation to discover whether a useful field of research into prevention might be opened up by this approach. It seems that it might, and that some little time may elapse before it will be either possible or necessary to separate research into the proximate cause of parodontal disease from research into the proximate cause of interstitial caries.

The future programme

The immediate task would seem to be to survey the corresponding human tissues and to make a much more detailed examination of the comparative material that has been reviewed. There is also an obvious bacteriological approach to determine whether the bacteria at the tip of

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the papilla are proteolytic or acidogenic, and if proteolytic whether they actually live on the keratin or on protein debris. There might be a two-stage reaction in the destruction of keratin in the mouth as there is in the solution of the calcium salts. Proteolytic bacteria living on food debris might produce an enzyme or some other substance that can damage or destroy keratin just as the acidogenic bacteria live on carbohydrate debris and produce acid that dissolves calcium salts. It may not be necessary for the bacteria actually to live on the keratin.

Concentration on the local reaction must not, however, be allowed to exclude consideration of the possibility of there being a constitutional factor in this early destruction of keratin so that it seems reasonable not only to explore bacteriologically and biochemically all possible means by which keratin might be destroyed in the mouth, but also to attempt a more fundamental approach and review any influence which may be found to interfere with or promote the normal process of keratinisation. For this purpose it may be useful to compare normal with aberrant and neoplastic forms of keratinisation and this it is hoped to attempt in the new department through clinical contacts that have already been established.

There are also other problems for the biochemist besides those concerned with the destruction of keratin. He may be able to determine whether the keratin of the gum margin is chemically identical with that of enamel and whether the latter alters as it gets older. If it does not, it would be interesting to know why, on decalcification, the younger enamel of a persistently growing tooth such as that of the guinea pig, always leaves an organic residue, or some kind of residue, while the same animal's enamel as it gets older does not. In a word, it seems as important to explore the physiology and biochemistry of keratin in studying prevention as it does to explore the collagen field in relation to the later stages of parodontal breakdown.

Whether anything could be done, perhaps by some therapeutic means or dietetic supplement, to render this keratinous seal of the tooth or the papilla more resistant, or whether some restraint could be put on the destructive or penetrating agent whatever it be, to prevent it from destroying the keratinous seal, remains to be seen but it does seem to be important in seeking to prevent both parodontal disease and caries. The work which is being carried out in the department on the concentration of radioactive iodine in the saliva is one of many approaches to these fundamental problems.

CONCLUSION

There has of course only been time to present a brief analysis of just one aspect of the research to which the department is committed and to give an outline of the way in which we hope to approach it. It is perhaps our good fortune that some of the fundamental problems may be related

SIR WILFRED FISH

to both parodontal disease and caries ; for the department is in any case very small for a task of this kind which calls for experts in so many fields. It is therefore all the more important that energy should not be dissipated on uncoordinated projects, but be directed systematically towards a specific goal.

The system must nevertheless be kept flexible. For instance if it were found from the clinical survey that the earliest manifestation of impending parodontal breakdown was not ulceration but was some disturbance in the bone related to occlusal stress, attention would have to be concentrated on the connective tissue supporting the teeth, more closely than on the epithelium and the keratinous cuticle, but the marginal ulceration would still have to be explained and its incidence prevented. Developments of this kind, therefore, would only call for a change of accent and require intensification of effort in certain directions with perhaps some inevitable relaxation in others or at least a review of priorities. It would not mean that effort has been wasted. Nor would effort have been wasted if it were to appear in due course that the local assault on the tissues is nothing more preventable than the inevitable wear and tear inseparable from civilised life or that the determining factors in susceptibility are systemic and constitutional.

In conclusion I would like to make an acknowledgment. This whole plan has been worked out in close co-operation with my colleague, Mr. Cohen, and if my earlier remarks about enthusiasm and curiosity and a research worker finding his own problem have any significance, no research should ever be "directed." It should only be co-ordinated and perhaps attracted into useful channels by mutual enthusiasm for the same great purpose. This is only a part of my indebtedness to him for he has shared fully in the labour of overcoming the constant obstacles that impede the establishment of a new enterprise of this kind.

Finally I would like to close as I began ; for this occasion was devised by the Faculty of Dental Surgery for the purpose of paying tribute to the President under whose direction the Faculties were established in the College. Our Faculty undertook "to encourage study and research in the field of dental surgery and cognate subjects," and I have tried to show how in the last decade this purpose has been kept in view and that our enterprise in dental research is a part of that purpose. It is only in so far as the Faculty continues to play its part in the evolution and development of dental surgery that we can hope to repay the debt we owe to Lord Webb-Johnson in whose honour we have met today.

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PRESERVATION OF THE ANAL SPHINCTERS IN THE RADICAL TREATMENT OF RECTAL CANCER

Lecture delivered at the Royal College of Surgeons of England

on

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by

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I DON'T SUPPOSE I need to remind you that the subject of my lecture this afternoon has been one of the burning questions of surgery in recent years—an issue in fact that has never failed to divide any previously friendly gathering of general surgeons almost immediately into two hostile groups. One believed that the last word on the subject had already been said in 1910 by Ernest Miles, whose comprehensive researches, showing the extensive nature of lymphatic spread in several different directions from rectal cancer, had apparently established beyond all dispute the necessity for complete excision of the rectum, including the sphincter apparatus, in all cases of rectal carcinoma wherever situated. To this group any attempt at revival of sphincter-preservation in the radical treatment of this disease was most retrograde and indeed quite unethical. Included among the supporters of this group, I may say, have been some of the most honoured and respected figures in British and American surgery—men such as Gabriel, Abel, Lahey, Rankin, Allen and Cattell—whose combined opinion represents a wealth of surgical experience and thought not lightly to be disregarded.

The other, hitherto much smaller group, for whom I am the spokesman to-day, pointed rather to the painstaking researches in the early 1930s of Westhues (1930, 1934) in Germany, and Dukes (1930, 1940) in this country, who had failed to confirm the findings of Miles (1910, 1926) in certain important respects, notably in regard to downward and lateral spread. So far as could be judged from their meticulous examination of literally hundreds of operative specimens, spread from rectal cancer—except in very advanced and presumably incurable lesions—took place practically exclusively in an upward direction, closely along the superior haemorrhoidal and inferior mesenteric vessels. Certainly with carcinomata of the upper rectum and rectosigmoid it did not appear from their specimens that anything had been gained from sacrificing more than 1 in. or so of rectal wall and perirectal tissues distal to the lower edge of the primary growth. Their work then suggested strongly that sphincter-preservation ought to be compatible with thorough excision, at any rate of carcinomata of the upper rectum and rectosigmoid.

Well, despite much criticism and bitter opposition sphincter-saving resections of various kinds have been subjected to further trial in a number of centres in America and this country during the past decade or so. This afternoon I should like to tell you something about these

operations, and to attempt an assessment of their value in actual practice, for I think sufficient data have now accumulated to permit of a reliable evaluation in terms of both immediate and late results.

CHOICE OF OPERATION

A number of different operative techniques have been described for resection of rectal carcinomata with restoration of continuity, but some of these are now only of historical interest. Four main methods may be recognized :

First, sacral resection

On the Continent, due to the influence of Kraske (1885), Hochenegg (1888, 1889) and Küttner (1910, 1916), excision of the rectum by the sacral route was, till recent years, the most popular method in many surgical clinics. Sometimes the excision took the form of a complete removal or *amputation* of the rectum with establishment of a sacral colostomy, but not infrequently it was possible to conduct this as a *segmental resection* with restoration of continuity, and in the famous Hochenegg Clinic in Vienna many hundreds of these sacral resections were performed (see Mandl, 1922, 1929). This form of resection, however, suffered two disadvantages. First, despite the development of several different methods of anastomosis designed to guard against leakage, breakdown of the colo-rectal junction was very common, leading to the formation of an intractible faecal fistula through the posterior wound. Secondly, by modern standards sacral resection must be adjudged an inadequate operation so far as removal of the tissues of the upward zone of lymphatic spread is concerned, for through a purely sacral wound it is impossible to effect a really high ligation of the superior haemorrhoidal or inferior mesenteric vessels. The highest level that can be reached as a rule from below is a point 1 in. or more below the sacral promontory, which is on the average $3\frac{1}{2}$ in. below the bifurcation of the abdominal aorta and 5 in. below the actual origin of the inferior mesenteric artery (Goligher, 1949). In the recent revival of sphincter-saving resections therefore it was natural to turn rather to methods incorporating an abdominal phase which permitted of ligation at these higher levels as in an orthodox combined abdomino-perineal excision.

Secondly, abdomino-sacral resection

This operation has been extensively practised in recent years by Finsterer (1941) and Goetze (1944) and above all by d'Allaines (1956) of Paris. It was also the first method employed by Pannett (1935), one of the earliest pioneers of sphincter-saving resection in this country. Unfortunately the risk of formation of a persistent faecal fistula through the posterior wound still remains as in sacral resection, as Goetze (1944) and d'Allaines (1956) clearly recognize. In addition the patient is exposed to all the ordinary discomforts of a perineal or sacral wound, which certain

other techniques avoid. It has never been a popular method in this country, and it is significant, I think, that Pannett (1951) eventually gave it up in favour of a purely abdominal resection.

Thirdly, abdomino-anal resection

The most popular operation of this type is the "*pull-through*" *abdomino-anal resection* associated with the names of Babcock (1932, 1940), Bacon (1945) and more recently Black (1952). The resection is carried out mainly from the abdominal aspect, down to a level just above the anal sphincters. In the Bacon (1945) version, which is the one most commonly practised, continuity is then restored by a method similar to the "*durch-zug*" technique developed by Hochenegg in connection with sacral resection; in other words the mucosa of the ano-rectal stump is excised—the internal sphincter usually being removed inadvertently in the process—and the colon is drawn down through the bared anal canal (see Mandl, 1922). When, after ten days or so, union has taken place between the outer aspect of the colon and the inner raw surface of the canal the excess of colon projecting from the anus is removed by diathermy.

My criticism of this operation is that though it preserves the sphincters—or at any rate the important external one—it sacrifices the sensitive anal and lower rectal mucosa which is just as important in the mechanism of continence as is the musculature itself, and as a consequence the patients suffer from what may be termed sensory incontinence. Bacon (1945) and Waugh, Miller and Kurzweg (1954), who have used this operation extensively, admit that most of the cases after it are not properly continent, but claim that about a third of them have something akin to normal function. My experience of eight patients on whom I performed the Bacon operation, taking special care to preserve both anal sphincters in an undamaged condition, was that they were all incontinent and had nothing better than anal colostomies. Four of them were subsequently converted at their own request to abdominal colostomies, with much more satisfactory results.

An alternative technique for abdomino-anal resection is that of Maunsell (1892) and Weir (1901). Here after an entirely abdominal dissection the rectum is resected leaving a long colon stump and a short ano-rectal one. These are then joined together by a method very similar to Hochenegg's invagination technique for anastomosis after sacral resection (see Mandl, 1922). That is to say, the ano-rectal stump is turned inside out through the anus so that its cut upper margin becomes the projecting lower edge, and the colon stump is then drawn down through it so that the free edges of both stumps lie opposite one another and can be sutured together outside the anus. The anastomosis is then pushed back through the anus into the pelvis.

This method enables one to achieve a very low colo-rectal anastomosis without sacral or perineal wound, and without sacrificing the mucosa of the anal canal or rectum, or damaging the anal sphincters. The functional

results are accordingly very much better than after the Bacon-Babcock operation, and the majority of patients eventually attain normal continence after it. However, many of them pass through a rather uncomfortable phase at first when they are troubled by frequent small motions, and their control for flatus and liquid faeces may be somewhat impaired. It is in fact usually four to six months before rectal function becomes really worthwhile. It must be admitted also that complications referable to breakdown of the anastomosis are particularly common after this operation, and a proximal transverse colostomy must always be established at the time of the resection or as a preliminary. This method used to be popular with my colleagues and myself at St. Mark's Hospital, but in recent years I have seldom used it.

And fourthly, and most important of all, abdominal or anterior resection

Some forty years ago several surgeons such as Rutherford Morison (1943) of Newcastle, Balfour (1910) of the Mayo Clinic, and Lockhart-Mummery (1934) here in London performed a certain number of purely abdominal resections of carcinomata of the rectosigmoid. Continuity was restored by tying a stout rubber tube into the upper stump and drawing this piece of bowel into the lower stump, the upper edge of the latter then being united by a few stitches to the outer aspect of the colon above the tube. But the results were not very satisfactory. The modern anterior resection has nothing to do with this technique and is completed entirely by suture. It might be termed the Mayo Clinic operation for the credit for popularizing it undoubtedly lies with Dixon (1939, 1944) and his colleagues Mayo, Waugh, Black and Judd of the Mayo Clinic. Wangenstein (1945) has been another very influential advocate of this operation. Certainly by this method it is possible to deal with practically all growths of the intraperitoneal part of the rectum and the rectosigmoid without having to resort to an abdomino-sacral or -anal technique to complete the anastomosis. It is undoubtedly an advantage to be able to avoid these latter methods, because after anterior resection healing of the anastomosis is much more certain and, due to the larger rectal stump retained, the functional result is always perfect. In my own practice and that of most other surgeons of my acquaintance such as Nauntun Morgan, Lloyd-Davies and other colleagues at St. Mark's and elsewhere who undertake sphincter-saving excisions, it is only very rarely now that any other form of resection is ever used. All my further remarks therefore will refer entirely to this operation which I have now performed on 137 occasions for cancer of the rectum and rectosigmoid.

SELECTION OF CASES FOR ANTERIOR RESECTION

First of all let me tell you what types of patient we have selected for this operation. The main criterion in deciding on the suitability of a case for anterior resection has undoubtedly been *the height of the growth*. Like many other surgeons I have decided somewhat arbitrarily to restrict the

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use of anterior resection to cases with *growths above the peritoneal reflection*. This has simplified the technical problems, for it is usually fairly easy, except in obese male patients with a narrow pelvis, to remove growths by anterior resection anywhere down to the reflection, but much more difficult to carry out this operation for lesions at a lower level.

The peritoneal reflection is a somewhat variable landmark, but normally it lies about 8 to 10 cms. from the anal verge on sigmoidoscopy, or roughly as far as the finger can feel on digital examination of the rectum. As Naunton Morgan expressively puts it "growths that can be *easily* felt on rectal examination are *too low* for anterior resection."

I should like to emphasize that as a rule, contrary to the practice of some other surgeons, I have made no attempt to select for resection only those cases adjudged clinically and at operation to have specially early growths. I have taken this stand because I am convinced that it is impossible to decide, prior to pathological examination of the excised specimen, exactly how extensively a growth has spread. The only step I have taken towards selection of cases according to the state of their growth, has been to carry out routine pre-operative sigmoidoscopic biopsy. Any case showing a highly active anaplastic type of growth on histological section has been excluded because of the risk of unusually wide spread in the bowel wall with such lesions—sometimes up to 3 or 4 in. (Goligher, Dukes and Bussey, 1951; Quer, Dahlin and Mayo, 1953). Such patients are usually incurable anyway, so I suppose it doesn't really matter, but anterior resection might result in a troublesome local recurrence.

Special mention should be made of *cases with hepatic metastases*. Obviously the palliative value of excision for patients is greatly enhanced if it can be carried out as a resection without sacrifice of the sphincters. When therefore hepatic deposits are present every effort has been made to perform a resection rather than an ordinary excision, the indications being sometimes stretched so as to include rather lower growths than would normally be accepted for resection with a view to cure.

OPERATIVE TECHNIQUE

And now I should like to direct your attention to a few of the more important points in the technique of anterior resection.

Preliminary or simultaneous transverse colostomy

First of all, the debatable question as to whether a preliminary or simultaneous transverse colostomy should be established or not. In the earlier days of anterior resection when the influence of Devine's teaching was still strong, it was quite unthinkable to do this operation without a preliminary transverse colostomy. This was placed well to the right, close to the hepatic flexure, so as to leave the left half of the abdomen and the left colon undisturbed for the subsequent resection two or three weeks later. During the interval between the two stages the colon was cleansed

and sterilized by irrigations from the colostomy to the anus and vice versa, and by insertion into the colostomy of suppositories containing sulphathaladine.

However, as confidence was gained in the efficacy of non-absorbable sulphonamides and antibiotics in bowel preparation a preliminary colostomy was discarded, except of course when the patient was admitted with acute or subacute obstruction. Instead, for a time *simultaneous* transverse colostomy was freely employed, the colostomy being established *at the conclusion* of the main resection operation, with the object of reducing somewhat the strain on the anastomosis. Finally, and for the greater part of the time, the use of simultaneous colostomy was restricted to those few cases where the anastomosis had proved exceptionally difficult or the colon had been unduly loaded. When a colostomy is employed now the limbs of the loop are not "double barrelled," for in the subsequent closure an enterotwine is not used but instead an entirely intra-peritoneal technique is employed usually with *resection* of the colostomy and end-to-end anastomosis.

For the average patient now anterior resection is performed as a one-stage operation without colostomy of any kind. The local and general preparation differs in no essential respect from that employed for abdomino-perineal excision, but naturally the more efficient the mechanical emptying of the colon by mild aperients and enemata or washes out, the more satisfactory the conditions for anastomosis.

Technique of resection

I think it is convenient to consider anterior resection as consisting of three fairly distinct phases: *the first* is concerned with the definition of the upper limits of the resection and includes ligation of the upper part of the inferior mesenteric vessels and the preparation of the colon stump; *the second* phase comprises mobilization of the rectum, division of the mesorectum and lower end of the superior haemorrhoidal vessels and preparation of the rectal stump; and *the third phase* is the actual anastomosis.

The first phase. Like all the preliminary parts of the operation—namely the positioning of the patient on the table, the emptying of the bladder, and the incision and exploration of the abdomen—the steps of the dissection leading up to the exposure of the stem of the inferior mesenteric vessels are *absolutely identical with those of an abdomino-perineal excision*. They consist of division of the adhesions on the outer side of the iliac colon and mesocolon, the incision of the peritoneum on either side of the base of mesosigmoid, the demonstration and lateral displacement of the left ureter, and finally the prolongation upwards of the incision in the right leaf of the mesosigmoid as far as the third part of the duodenum. Separation of the edges of this cut exposes the uppermost 2½ in. of the inferior mesenteric vessels and permits of their ligation separately or together just below the origin of the artery from the aorta. The effect

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of ligation at this level is of course to leave the entire left colon dependant for its blood supply on the marginal artery descending from the middle colic branch of the superior mesenteric.

The sigmoid loop is now held up to the light to demonstrate its vessels by transillumination and the peritoneum of the mesosigmoid is divided obliquely with scissors from the point of ligation of the inferior mesenteric vessels to the site selected for division of the colon. This cut crosses three vessels—the ascending left colic artery running to the splenic flexure, the left colic artery proper, and the marginal artery between the left colic and first sigmoid vessels—and these have all to be secured and divided (see Fig. 1a). Finally the colon is clamped by two closely applied Parker-Kerr clamps placed obliquely across the bowel, and divided between them, leaving the colon stump for use in the anastomosis controlled by the proximal clamp. Many people imagine that for anterior resection a specially long piece of bowel is required in order to reach down into the pelvis. This is quite incorrect. As a rule one needs no more colon for this purpose than for establishing an ordinary left iliac colostomy in connection with an abdomino-perineal excision. If, exceptionally, a greater length of bowel is needed it can be obtained either by preserving more of the sigmoid colon, nourished by the intersigmoidal marginal

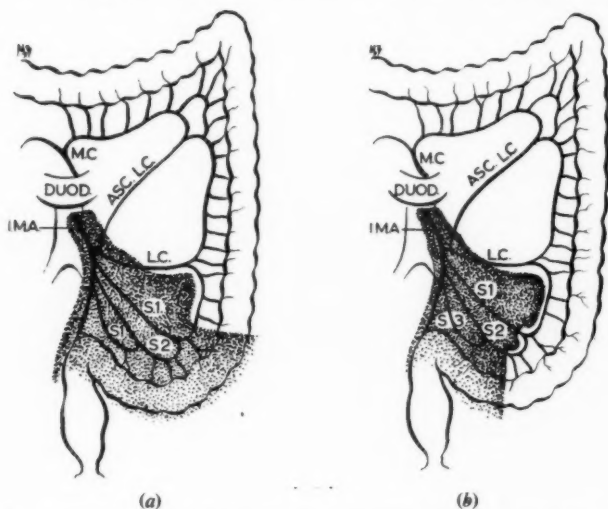
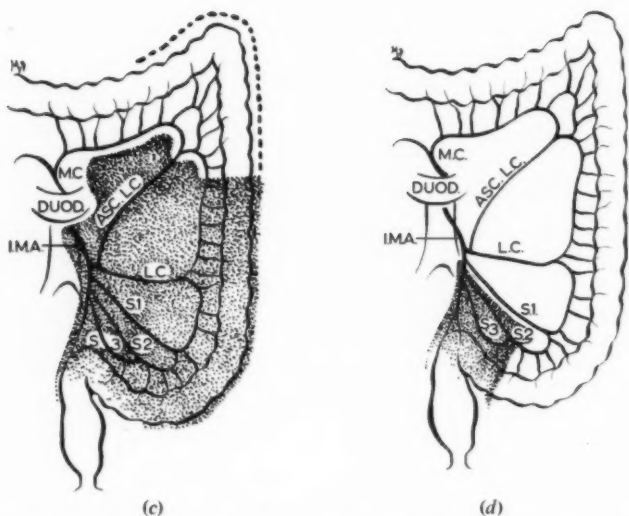


Fig. 1. *Preparation of the colon stump.* Diagrams showing various plans of ligation of the inferior mesenteric vessels and preparation of the colon stump in anterior resection:

- (a) The usual plan with high ligation of the main vessels and division of three arteries—the ascending left colic, the left colic and the marginal artery.
- (b) A similar arrangement but preserving more of the sigmoid colon nourished by the intersigmoidal marginal artery.



- (c) An alternative plan with high ligation of the inferior mesenteric vessels and sacrifice of left colon up to a point just below the splenic flexure which has been mobilised to extend down to the pelvis.
- (d) Low ligation of the inferior mesenteric vessels opposite the bifurcation of the abdominal aorta and below the first sigmoid artery.

arcades (see Fig. 1b), or preferably by dividing the peritoneum on the outer side of the descending colon and splenic flexure and mobilizing the entire left colon (see Fig. 1c). A convenient point can then be chosen on the descending or distal transverse colon for the proximal limit of the resection. Of course if the operation is being undertaken as a palliative procedure in the presence of hepatic metastases or if the patient is very obese making a high ligation technically difficult, it suffices to tie the inferior mesenteric vessels at a lower level, usually opposite the aortic bifurcation (see Fig. 1d). This generally preserves a direct blood supply to the end of the colon stump through the first sigmoid artery.

With any of these preparations of the colon stump it is of course essential to satisfy oneself as to the adequacy of the blood supply to the bowel. This is generally made quite clear by the retention of its normal pink colour. The pulsation of the small arteries in the wall of the colon and adjacent mesocolon, which is often mentioned in this connection, is in fact an unreliable guide, for it is often abolished temporarily immediately after ligation of the main inferior mesenteric artery, presumably due to spasm which later relaxes. Because of this latter fact it is wise, even when some doubts are experienced about the colour of the bowel, not to be in a hurry to assume that the supply is inadequate. It is better to review the

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state of the colon stump at a later stage of the operation just before the anastomosis. If any dubiety remains then it can be settled by cutting one of the small mural arteries and noting whether this gives rise to *arterial* bleeding or not. If the supply is unsatisfactory the resection should be carried as far proximally as necessary to obtain a good supply, and this will probably mean going up to the distal transverse colon, but in my experience this has seldom been required.

In the *second phase* of the operation the freeing of the rectum from the sacrum posteriorly, and from the bladder, vesicles, and prostate or uterus and vagina anteriorly, and the definition and division of the lateral ligaments on either side are carried out *exactly as in an abdomino-perineal excision*. The result is that the rectum is completely mobilized as far as the ano-rectal junction.

The next step is to separate the mesorectum from the back of the rectum at the level selected for division of the bowel below the growth, which should be *not less than 2in.* from its inferior edge. This is done by scissor dissection aided by gauze pushers. The mesorectum is now clamped with two large artery forceps or crushing internal clamps and divided between them (see Fig. 2a). The ends are then tied off, leaving the rectum bared all round over a segment about 1½in. long.

The bowel is now clamped at the upper end of this bared segment to prevent further faeces descending into the rectum whilst the latter is

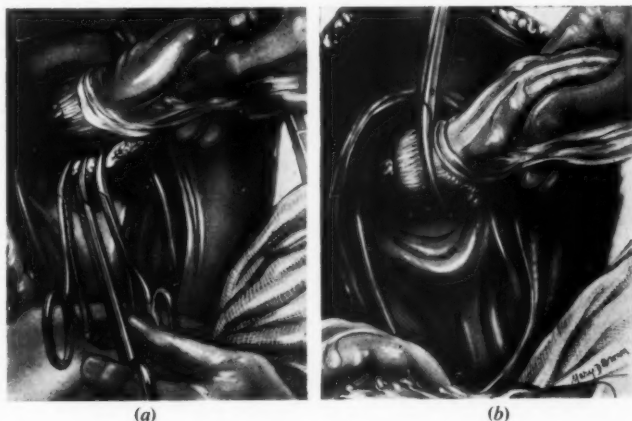


Fig. 2a. *Preparation of the rectal stump.* Division of the mesorectum after mobilisation of the rectum on all aspects down to the ano-rectal ring as in an abdomino-perineal excision.

Fig. 2b. *Preparation of the rectal stump.* Clamping the rectum prior to its irrigation and division. Note that an ordinary curved Parker-Kerr clamp is used, applied exactly in the sagittal plane with its concavity uppermost, and two inches below the lower edge of the growth.

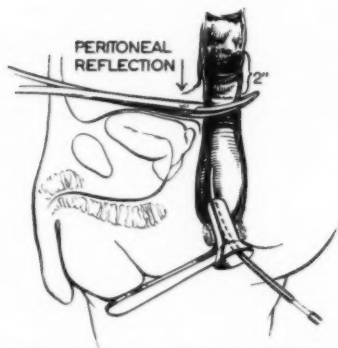


Fig. 3. *Preparation of the rectal stump.* Irrigation of the rectal stump through a proctoscope with a 1/500 solution of perchloride of mercury.

irrigated from below. Many surgeons employ a right angled clamp for this purpose but I prefer to use an ordinary curved Parker-Kerr clamp applied *exactly in the antero-posterior or sagittal plane*, with its handles just above the pubis and its concavity uppermost (see Fig. 2b). An assistant now passes a proctoscope per anum and through a rubber catheter irrigates the rectum up to the clamp with $1\frac{1}{2}$ to 2 pints of 1/500 perchloride of mercury, and finally swabs it dry (see Fig 3).

This method of washing out the rectal stump has the advantage that it avoids a certain amount of contamination when the bowel is eventually divided. By removing or destroying any loose carcinoma cells present in the lumen below the growth it may also reduce the dangers of implantation metastases arising on the suture line, as I will mention later. But irrigation is only practicable if the patient is in the lithotomy-Trendelenburg position as for a synchronous combined excision.

Before leaving the preparation of the rectal stump I should explain that if the carcinoma is situated in the rectosigmoid region 3 or 4in. above the peritoneal reflection it is not necessary to mobilize the rectum on all aspects down to the ano-rectal ring. The cuts on either side of the mesorectum are not extended round the brim of the pelvis but instead run to the back of the rectum 2in. below the growth (see Fig. 4a). The superior rectal vessels can then be divided at this level, leaving a rectal stump which projects an inch or two above the peritoneal reflection and has a surrounding cuff of peritoneum. One often passes a hand down between the rectum and the sacrum to mobilize the rectum somewhat posteriorly, but the lateral ligaments are not divided and there is no anterior dissection.

The third phase is the actual anastomosis. In preparation for it the sigmoid and rectum above the Parker-Kerr clamp are drawn vertically

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upwards to lift the lower rectum as far as possible out of the pelvis and facilitate the insertion of sutures into it, in the same way as traction exerted on the body of the stomach is useful during gastrectomy. The clamp controlling the end of the colon stump is rested on the left edge of the abdominal wound, with its mesenteric border directed posteriorly, and separated by a distance of 4 or 5 in. from the rectum. A series of mattress Lembert sutures of fine serum-proof silk is now inserted between the left lateral aspects of the rectum and the adjacent surface of the colon, $\frac{1}{2}$ in. distant from the controlling clamps in either case, and left untied till all have been placed (see Fig. 4b). The colon is then slid down on these sutures to come into apposition with the rectum, and the stitches are tied, the tails of the first and last being retained for traction, all the others being cut. The crushing clamps are now excised with a scalpel, and in the case of the rectum this means also removal of the entire operative specimen (see Fig. 5a). This rectal stump is of course nourished only by the inferior haemorrhoidal arteries, the middle haemorrhoidal having been divided in the lateral ligaments, but the rectum usually gives reassuring evidence of an adequate blood supply. The edges and terminal

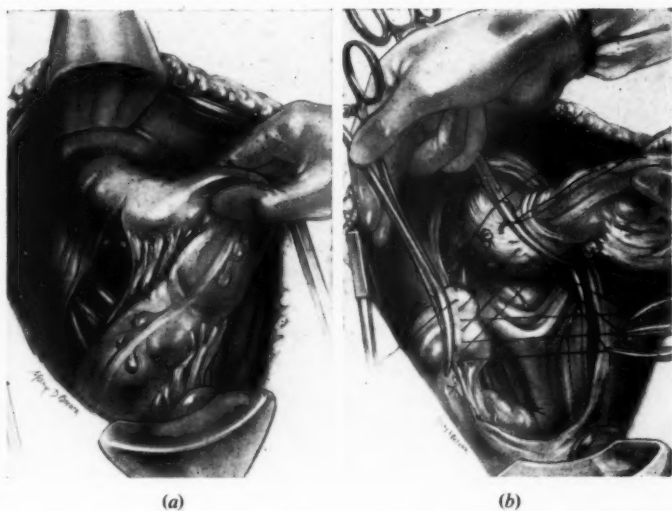


Fig. 4a. *Alternative preparation of the rectal stump.* In cases with carcinomata in the rectosigmoid an entirely intra-peritoneal operation can be performed, with division of the superior haemorrhoidal vessels on the back of the rectum 1 in. or 2 in. above the pelvic peritoneal floor.

Fig. 4b. *The anastomosis.* Left lateral row of Lembert sutures being inserted. Note that the colon and rectal stumps are 4 in. or 5 in. apart, with their mesenteric borders directed posteriorly, and that the sutures are placed as mattress stitches. They are left untied till all have been inserted.

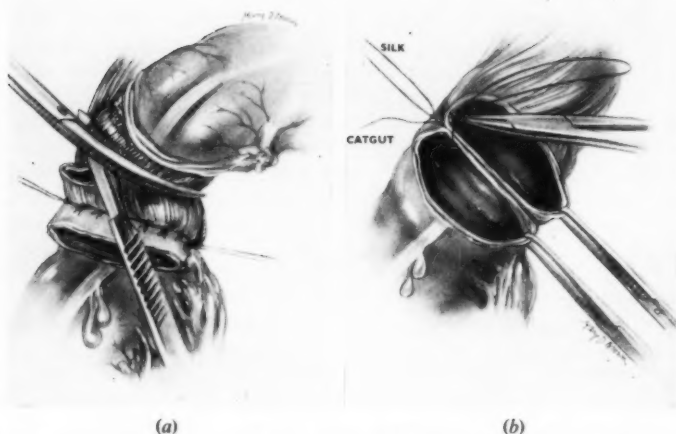


Fig. 5a. *The anastomosis.* The colon stump is slid down on the Lembert sutures to come into apposition with the rectum, and the stitches are tied. The clamps are then excised removing any crushed tissue with them.

Fig. 5b. *The anastomosis.* The continuous through-and-suture of fine chromic catgut on a fine atraumatic Kelly needle. This commences at the anterior or antimesenteric borders of the colon and rectum.

part of the interior of the colon stump are swabbed with a 1/500 solution of perchloride of mercury.

A continuous No. 1/0 or 2/0 chromic catgut suture on a fine curved atraumatic needle is used to unite the cut edges of the colon and rectum. This proceeds from front to back (see Fig. 5b) and when the mesenteric poles are reached posteriorly it changes from a simple over-and-over stitch to a Connell or "loop on the mucosa" stitch to give good inversion of the right lateral edges (see Fig. 6a).

Finally the right lateral row of Lembert stitches is inserted. These sutures of serum proof silk are, like the left lateral row, placed mattress-wise for as such they secure a better grip of the longitudinally running muscle fibres of the rectum, and are actually much easier to insert in the depths of the pelvis than are simple cross stitches (see Fig. 6b).

The anastomosis has now been completed and it only remains to *extra-peritonealise* it by suturing the pelvic peritoneum over it. But before doing so the extra-peritoneal pelvic cavity is drained by a strip of corrugated rubber inserted beneath the pelvic peritoneum at the side of the bladder to the region of the anastomosis and brought out at the lower end of the abdominal wound (Figs. 7a and 7b). A para-coccygeal drain

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might seem more logical, but I prefer this suprapubic one for two reasons : first, because I am a little frightened lest the too easy drainage provided by the former should encourage the development of a persistent faecal fistula as after sacral and abdomino-sacral resections, and secondly, because once the bowels start acting it would be difficult to avoid retrograde contamination along a drain in the coccygeal region.

Some surgeons such as Wangenstein (1945) like to have a stout rectal or stomach tube passed per anum by an assistant during the operation, the point being negotiated through the anastomosis by the surgeon to lie in the colon 3 or 4 in. above it. The tube is extracted half an inch or so each day, and removed completely after four or five days. It is hoped thereby to decompress the large intestine and protect the suture line. Other surgeons such as Mayo (1952) prefer simply to stretch the anal sphincters vigorously at the conclusion of the operation to paralyse them temporarily and prevent accumulation of flatus in the rectum under tension. I have used both these manoeuvres in the past but more recently have given them up completely, with no apparent alteration in the results.

With suitably long retractors, scissors, needle holders and other instruments, and experience of the technique, anterior resection is not usually a difficult operation. However, it does take a little longer than the average

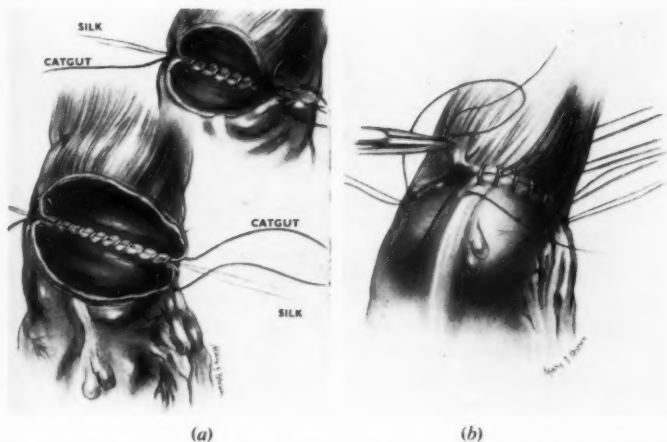
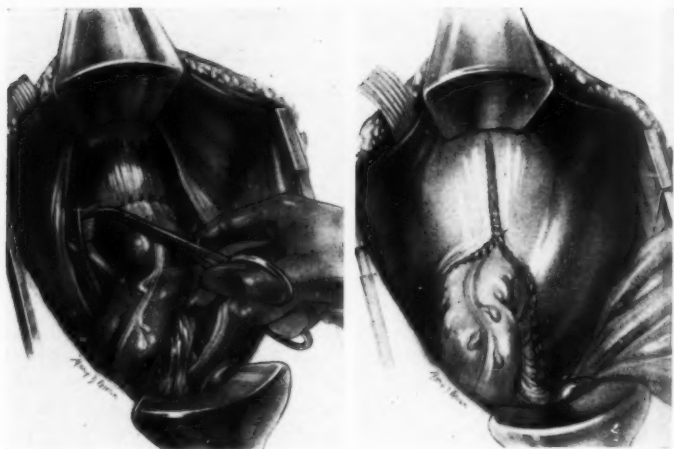


Fig. 6a. *The anastomosis. The continuous through-and-through suture.* A simple over-and-over stitch is used for the left lateral edges, but this changes to a Connell or "loop on the mucosa" stitch at the posterior poles and is continued as such along the right half of the bowel circumference to secure good inversion of the edges.

Fig. 6b. *The anastomosis. Right lateral row of Lembert sutures being inserted.* These are also placed mattress-wise.



(a)

(b)

Fig. 7a. Insertion of *extra-peritoneal* drain to the site of the anastomosis.

Fig. 7b. Suture of pelvic peritoneum, *extra-peritonealising* the anastomosis.

combined excision, and can seldom be completed in less than an hour and a half. My anaesthetists and assistants, however, are unanimous in their opinion that the condition of the patients at the end of these operations is distinctly better than after a formal combined excision, presumably because of the avoidance of the haemorrhage and shock associated with the perineal phase of the latter.

POST-OPERATIVE CARE

The post-operative care follows the general lines of treatment after any major abdominal operation such as an abdomino-perineal excision. The bowels usually act spontaneously or with the assistance of glycerine suppositories about the third or fourth day or sooner. The urethral catheter is retained for four to five days and the *suprapubic drain* for at least seven days to form a definite track to the surface in case of leakage, which is not uncommon.

RESULTS

So much for the theoretical and practical considerations governing the use of anterior resection and the place which some of us have been prepared to accord it temporarily in the treatment of rectal cancer. What have been the results?

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First of all, the immediate results

It was expected by many surgeons that these operations would inevitably be followed by an increased operative mortality and morbidity due to leakage and sepsis.

In my 137 anterior resections there have been fourteen operative deaths giving an immediate mortality of 10.2 per cent. This compares satisfactorily with the operative mortality of ordinary combined excision, which in my hands over a period of several years has been approximately 11 per cent. Both these figures are relatively high, but that is partly accounted for by the inclusion of many poor risk cases undergoing purely palliative excisions.

The disturbing fact must be faced, however, that sepsis was the cause of death in no less than five of the anterior resection cases (see Table I) and that there were non-fatal septic complications in a number of others, for *breakdown of the anastomosis* at some part of the bowel circumference, usually posteriorly, was quite common and occurred in roughly one case in four of the entire series. In a third of the cases so complicated, or one in twelve of the total series, there was an actual leakage of faeces from the bowel to the surface along the suprapubic drain track, but it was surprising how innocuous this development could be, and how readily the fistula dried up, sometimes even without a proximal colostomy having to be established. Serious separation of the suture line was almost confined to cases which had had a really low resection for growths at or just above the peritoneal reflection. In such cases even a preliminary or simultaneous transverse colostomy could not be relied upon to prevent separation entirely but it possibly reduced its incidence and extent, and could perhaps have been used more frequently with advantage.

TABLE I

CAUSES OF OPERATIVE MORTALITY AFTER 137 ANTERIOR RESECTIONS FOR RECTAL CARCINOMA

Peritonitis	4 cases
Pulmonary embolism	3 cases
Coronary occlusion	3 cases
Broncho-pneumonia	2 cases
Pelvic abscess	1 case
Shock	1 case

14 cases

(10.2 per cent. mortality)

I should also mention that though there was often considerable narrowing at the site of anastomosis in the early post-operative period, this usually widened spontaneously in the succeeding months, presumably due to the dilating effect of the faeces. Only in cases with a severe degree of breakdown of the suture-line requiring a temporary defunctioning colostomy for several weeks did really troublesome stenosis develop requiring instrumental dilatation. I have had only four such strictures in my cases.

So far as the immediate results are concerned then, it would appear that anterior resection is no more dangerous than combined excision and despite troublesome and tedious complications in some of the cases the average period of hospitalization is shorter than with the latter operation. I am confident that even better results could be obtained by a more discriminating selection of cases for the operation and possibly by a readier resort to a proximal colostomy.

Secondly, the long-term results

Local recurrences

The opponents of anterior resection naturally prophesied that its introduction would result in a high incidence of local recurrence and a corresponding deterioration in the five-year survival rate as compared with that of combined excision. Well, early experiences were certainly disappointing and seemed to confirm these fears, for local recurrences were quickly reported by a number of surgeons (Morgan, 1950; Lloyd Davies, 1950; Goligher, Dukes and Bussey, 1951; Warren Cole, 1952; Judd and Bellegie, 1952). For a time indeed it began to look as if Miles had been right in his teaching about the iniquities of sphincter-preservation in rectal cancer. Though some of the recurrences clearly originated in the tissues of the pelvis outside the bowel, it was remarkable that the majority apparently commenced in the bowel wall itself, most often at the site of anastomosis, sometimes elsewhere in the rectal stump. It seemed that some of them, appearing four or five years after the operation, might be fresh primary carcinomata, whilst others were possibly due to implantation on the suture line of loose carcinoma cells mixed with the faeces in the lumen of the rectum. But many of them were presumably ordinary recurrences due to incomplete excision, and in a few instances indeed it appeared from examination of the original operative specimens that the resection had been somewhat "skimped," especially in regard to removal of macroscopically normal bowel distal to the growth. However, before condemning the operation, it had to be remembered that local recurrences are also found sometimes after ordinary combined excision, but because of the much greater difficulty in demonstrating them clinically in such cases are probably often overlooked.

One effect of these recurrences after anterior resection was to stimulate a scrupulous re-examination of the pathological basis of the operation, particularly in regard to the amount of "normal" tissue—both rectal wall and perirectal fat, vessels, and lymphatics—that should be resected distal to the growth, to ensure adequate clearance of the lesion in that direction. From an investigation of the records of 1,500 specimens at St. Mark's, Dr. Dukes and I came to the conclusion that a 2 in. margin was certainly preferable to the 1 in. laid down by Westhues (1934), partly as a safeguard against misjudgment of the exact distance at the time of operation (Goligher, Dukes and Bussey, 1951), and later work by Grinnell

(1954) has strongly supported this recommendation. As regards the risk of implantation of carcinoma cells from the bowel contents on to raw areas at the time of operation, the practice of washing out the rectum with a 1/500 solution of perchloride of mercury, first suggested by Naunton Morgan, was adopted as a routine in the hope of getting rid of any detached cancer cells in the rectal lumen.

Since directing attention to these details of technique designed to guard against inadequate distal removal or implantation, the number of local recurrences encountered by me personally after anterior resection has diminished markedly. Thus in my first thirty-five cases there were four local recurrences, mostly within a year or two of the operation, but in the following 102, there have so far been only two recurrences. Whether this alteration has been due to the measures mentioned, or is entirely fortuitous, it is impossible to say.

Five-year survival rate

However, the ultimate assessment of the curative value of anterior resection must obviously depend on a comparison between the five-year survival rate after it and after combined excision. Now in making such a comparison it is essential to bear in mind the selective nature of any series of cases treated by anterior resection, and to make sure that it is contrasted with a strictly comparable series treated by combined excision. Otherwise an inflated and quite misleading impression may be obtained of the value of the operation.

First of all you will appreciate from what I have said that anterior resection has been reserved mainly or entirely for growths of the intra-peritoneal rectum or rectosigmoid, and these are lesions which enjoy a specially favourable prognosis anyway. For example Gilchrist and David (1947) reported that in a group of 200 patients with carcinomata in different parts of the rectum, all treated by combined excision, the five-year survival rate for cases with intra-peritoneal lesions—which probably included some growths of the rectosigmoid—was 65.4 per cent., but for cases with extra-peritoneal lesions was only 51.8 per cent. Similarly Waugh and Kirklin (1949) in a follow-up of a large series of cases of rectal cancer treated by combined excision at the Mayo Clinic found that the five-year survival rate for growths of the lower third was 46.2 per cent., of the middle third 51.1 per cent., and of the upper third 53.8 per cent.

Secondly, most series of patients treated by anterior resection contain an exceptionally high proportion of women, for the wide female pelvis is conducive to the performance of this operation for some growths for which in the narrower male pelvis it might be found impracticable. This higher proportion of females has an important influence on the over-all prognosis of the series for, other things being the same, women enjoy a 5 or 6 per cent. better five-year survival rate after any operation for rectal cancer than do men (Mayo and Fly, 1956).

And thirdly, as already mentioned, some surgeons try to reserve anterior

resection for early favourable growths, and though they probably make many mistakes in their assessment of the state of the growths at operation, in the long run this policy is likely to eliminate some of the more advanced lesions from their series of patients treated by resection.

It will be evident, therefore, that the results of anterior resection must be compared with those of combined excision for *growths of similar site and stage in patients of the same sex and age* distribution. It is only in the last year or two that comparisons satisfying some or all of these criteria have been undertaken.

The collective statistics of St. Mark's Hospital on the treatment of rectal carcinoma have recently been worked out by Dr. Dukes, and will shortly be published. Meanwhile Naunton Morgan (1955) gives a provisional report, in which the five-year survival rate is contrasted in two series of cases: (1) a consecutive series with growths situated above the peritoneal reflection, treated by anterior resection since 1943, and (2) a "made up" series of cases also with intra-peritoneal growths, adjusted as to the proportion of A, B and C lesions, and the sex ratio of the patients, and treated by combined excision prior to 1943, when anterior resection was first used at St. Mark's. Without giving full statistical details Morgan states that the five-year survival rates in the two series were practically identical—58.4 per cent. for anterior resection and 60.9 per cent. for combined excision, a difference that is not statistically significant.

From the Mayo Clinic also two most important reports have been published in the last year or so by Waugh, Block and Gage (1955) and Mayo and Fly (1956), which reach conclusions even more favourable to anterior resection for upper rectal growths than do the St. Mark's figures, but, I should say, on a slightly less satisfactory statistical basis.

CONCLUSION

I think the conclusion is now quite inescapable that for *suitably selected* carcinomata of the intra-peritoneal upper part of the rectum or of the rectosigmoid a *well-performed* anterior resection is capable of giving immediate and late results at least the equal of those obtained by orthodox combined excision. This type of operation therefore can now take its place as an established radical surgical procedure for lesions in this situation—an operation in fact which every surgeon who undertakes to treat carcinoma of the rectum *must* include in his repertoire if he is to do the best for his patients.

Having made that point, however, I should like to end on a note of caution, for now that anterior resection has been vindicated I can foresee there may be a tendency to abuse it. As I pointed out before, most of the troublesome complications of the operation in my experience have arisen when it has been applied, often with some technical difficulty, to rather lower growths than usual, just at or immediately above the peritoneal reflection, frequently as a palliative procedure. If, on the other hand, it is

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reserved for cases in which it can be performed easily, most of the immediate complications are avoided, and the convalescence as a rule becomes one of the smoothest in major abdominal surgery. My advice, therefore, is not to over-stretch the indications for the operation, and, further, to be prepared to admit that, though anterior resection is now the correct routine treatment for carcinomata of the rectosigmoid and intra-peritoneal part of the rectum, some rectal growths above the peritoneal reflection may still be more safely and smoothly treated by combined excision.

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CURIOSITIES OF NATURAL HISTORY

by

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IN A PREVIOUS article on this subject (*Ann. Roy. Coll. Surg.* **19**, 118-133, 1956), examples taken from the first section of the Physiological Series in the Hunterian Museum demonstrated many remarkable features in those structures designed "for the special purposes of the individual." In the second part of this series, designed to show the devices and adaptations that have been adopted by various living creatures to ensure the continuance of the race, the facts are just as astonishing.

Until the seventeenth century, there was a general belief in the possibility of spontaneous generation. Naturalists produced many instances to support this theory, such as the appearance of worms in tightly-sealed flasks of vinegar and the presence of grubs at the core of apples which showed no external marks of entry. In his *Historia Animalium*, Aristotle (384-322 B.C.) says: "Other insects are not derived from living parentage, but are generated spontaneously; some out of dew falling on leaves, ordinarily in spring-time, but not seldom in winter when there has been a stretch of fair weather and southerly winds; others grow in decaying mud or dung; others in timber, green or dry; some in the hair of animals; some in the flesh of animals. . . ." In 1668, however, Francesco Redi (1626-1698), physician to the Duke of Tuscany, published an account of his experiments on the generation of blow-flies and proved that worms arise in rotting meat not because of the putrefaction but as a result of the eggs laid there by the fly. He was still baffled by finding grubs in galls or nuts which were apparently intact and by the parasitic worms found internally in quadrupeds.

It was Marcello Malpighi (1628-1694) who began to solve the problem of gall formation by his own observations of the puncturing of the plant by the insect. But the matter is not quite so simple as it would appear for galls are not all formed in the same way. For instance, among these gall-forming insects, there are certain cases of alternate generations assuming different habits. The wingless parthenogenetic female of *Chermes* lays eggs on the spruce fir which action gives rise to an object having externally the appearance of a little fir-cone while inside it consists of compartments in which the aphids reside (Fig. 1a.). When the inhabitants are full-grown, the gall splits open, allowing the insects to escape—and these are winged females. They in turn may produce a generation of gall-forming wingless individuals like their "grandmothers." The cynipid insects have a different mode of work. *Rhodites rosae* favours the rose tree and produces the robin's pincushion or bedeguar, a leaf-gall

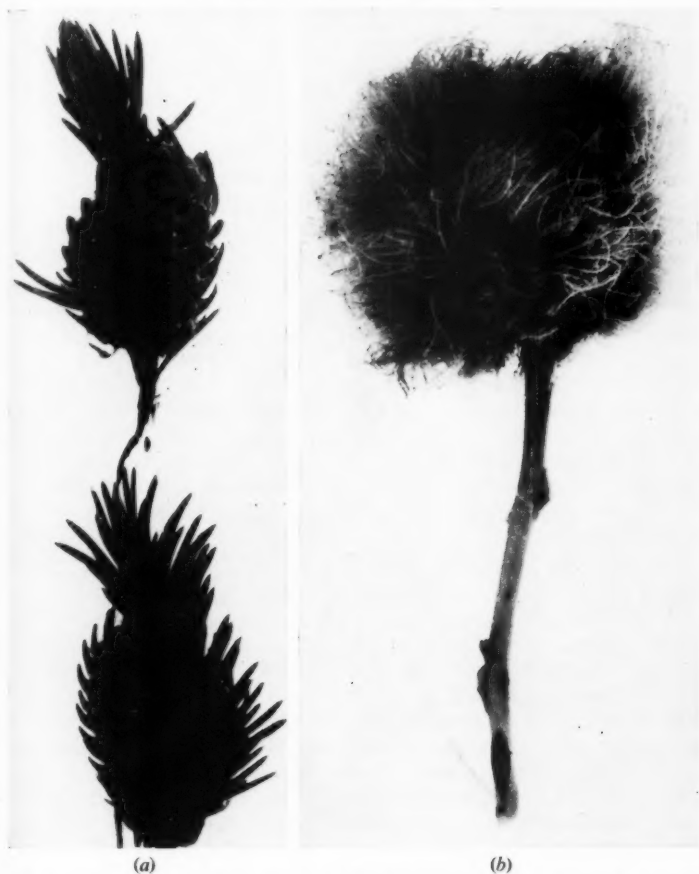


Fig. 1a. Hunterian specimen No. 2972, showing two galls formed on a Fire-tree. A longitudinal section has been removed from the upper one to show its compact structure and the cavities which the larval aphids occupy.

Fig. 1b. Hunterian specimen No. 2975, showing a twig of the common wild rose bearing the gall formed by *Rhodites rosae*.

(Fig. 1b). The female *Rhodites* pricks the leaf-bud in the three leaf rudiments which then fail to develop into leaves but gives rise to the gall which houses the larvae (See : Pazlavsky. *Biol. Centralbl.* ii, 1882, p. 617).

Nearly a century after Redi and Malpighi had reported their findings, Georges Louis Leclerc de Buffon (1707-1788) still favoured the theory of spontaneous generation. His explanation was that there were in space vast numbers of organic particles that are animate and that the animal

absorbs these with its food, thereby being enabled to reproduce itself. Even more curious to us are the ideas of one of Buffon's contemporaries, Julien Offroy de la Mettrie (1709-1751) who, adopting Buffon's idea of animate particles, postulated that man's origin was due to the accumulation of such particles in the earth.

A little later in the eighteenth century, in 1744, Abraham Trembley discovered the mode of propagation by division in the hydra. He also had the idea that the hydra could be propagated by eggs but he was not able to verify this. Recent investigations have tended to show that favourable conditions give rise to reproduction by budding but that in adverse circumstances, such as oxygen deficiency, egg formation is the rule. The two modes of generation frequently alternate (See: "Some astonishing properties of the Hydra." Sandoz. *J. Med. Sci.* April, 1956). In 1819, A. von Chamisso, famous as a poet and circumnavigator, was able to prove that in *Salpa*, one of the Tunicates, egg-producing alternates with propagation by division or budding. A few years later, Michael Sars, a Norwegian zoologist, showed that the jelly-fish also propagates by eggs and buds alternately. A similar two-fold power of reproduction is to be found in the plant *Bryophyllum calycinum* which, in addition to forming flowers and seeds in the ordinary way, develops buds from the angles of the marginal crenations on the leaf itself (2870-01; 2870-001).

The possibility of propagation by division roused interest in the faculty of regeneration. Richard Bradley in his *Philosophical Account of the Works of Nature*, published in 1721, suggests that if it is true that lobsters are able to renew claws that have been broken off . . . "we may suppose that the State of Lobsters is partly Vegetable, partly Animal; for Vegetables have a Power of renewing their Boughs or Branches when they are broken or cut off; but no Animal that I know of has the Power of renewing a lost Limb." He explains the curious appearance of the insect *Phyllium scythe*, or "walking-leaf," as the result of "being nourished, as I have observ'd, as well by the juices of the tree which the mother insect lays its eggs in, as by its own, which I suppose are so



Fig. 2. Hunterian specimen No. 2859.91, a lizard in which the tail had been broken off twice and in each instance regrowth had ensued.

united, that one and the other circulate equally in the Body of the Insect, till itself, with the leaves joining to it, drop from the tree, and creep upon the ground." Lazzaro Spallanzani (1729-1799) studied this problem of regeneration of lost parts in a more scientific way and it was possibly his writings that inspired John Hunter to make his researches on the regrowth of the tail in lizards. The specimens illustrating this investigation were collected while he was in Portugal during his service in the Seven Years' War and are therefore the earliest Hunterian preparations in the Museum (Fig. 2).

In addition to the theories already mentioned, the possibility of translocation was also seriously considered and one of the most entertaining formnces of this supposed method of reproduction is that provided by the barnacle goose and the barnacle. The legend that the bird hatched out from the crustacean was of long standing in the twelfth century. Giraldus Cambrensis (c. 1147-1223) complains that the clergy in Ireland eat barnacle geese at the time of fasting, under the pretext that they are not flesh but born of fish living in the sea. Aldrovandus gives an illustration in his work *De Avibus*, published in 1603, of the young birds just emerged from the barnacle shell (Fig. 3). And even as late as 1678 Sir Robert Moray writes a very convincing account in the *Philosophical Transactions of the Royal Society*, relating how he found a piece of timber on the shore with barnacle shells attached. "These shells," he says, "hang at the tree by a Neck longer than the Shell, of a kind of filmy substance, round and hollow and creased, not unlike the wind-pipe of a chicken, spreading out broadest where it is fastened to the tree, from which it seems to draw and convey the matter which serves for the growth and vegetation of the shell and the little bird within it. This bird, in every shell I opened, as well the least as the biggest, I found so curiously and compleatly formed, that there appeared nothing wanting, as to the external parts, for making up a perfect Sea-fowl; every little part appearing so distinctly that the whole looked like a large Bird seen through a concave or diminishing glass, colour and feature being everywhere so clear and neat. The little Bill, like that of a Goose, the Eyes marked, the Head, Neck, Breast, Wings, Tail and Feet formed, the Feathers everywhere shap'd and blackish colour'd; and the Feet like those of other Water-fowl." Rather sadly he remarks, however, "I never did see any of the little Birds alive, nor met with anybody that did. Only some credible persons have assured me, they have seen some as big as their Fist." (Fig. 4).

In spite of the fact that Tancred Robinson pointed out the fallacy in 1685 in the *Philosophical Transactions*, the legend persisted well into the nineteenth century; but the interest that the belief aroused probably led to the elucidation of the no less remarkable life history of the barnacle itself. It is owing to the researches of John V. Thompson, Deputy Inspector of Hospitals, that the true facts first came to be known. In

Vlyfsis Aldrouandi

Clavis generatio secundum aliquos.



Fig. 3. A reproduction of the illustration given by Ulysses Aldrovandus of the barnacle and the barnacle goose.

his *Zoological Researches and Illustrations on Natural History*, published in 1828, he points out the difficulties the earlier naturalists found in assigning the barnacle to its appropriate class. The key to the solution lies in the metamorphosis that this creature undergoes. The young cirriped is hatched out from the maternal mantle-cavity as a free-swimming nauplius, characterised by the presence of well-developed frontal horns and with pedunculated eyes. After a few days spent near the surface of the sea, further stages of the metamorphosis quickly lead to its final form—the stalk is developed and becomes attached to a floating log, the swimming legs are cast off, the eyes degenerate and, as Thompson remarks, it “furnishes not only a new and important physiological fact, but is the only instance in nature of so extraordinary a metamorphosis.”

Although with more accurate observation many of these fascinating theories had to be abandoned, the facts as they gradually emerged were no less astonishing. Throughout nature most elaborate precautions ensure that the race shall be continued. The seeds of plants are equipped in various ways for dispersal, protection and ultimate growth. Duckweeds and water lilies which float in summer on the surface of still water form in the autumn on their flattened stems certain organs which become detached from the plant and sink to the bottom of the pond where, during the winter, they remain protected from frosts. These structures have no air spaces and they contain the bud of the next year's plant. In the spring, the shoot grows and develops air spaces which cause it to float again to the surface in time for its summer existence. Among the insects, the water-spider, *Argyroneta aquatica*, provides an example of great ingenuity. Though an air-breathing creature, it spends most of its time beneath the water. The long hairs which clothe its abdomen and legs retain bubbles of air as it swims in the water so that, in effect, it carries its atmosphere around with it. Its problem is to provide its offspring with this supply of air, and to do this, the spider weaves beneath the surface of the water a silken dome, like a tiny parachute, which it attaches to a water plant. This it inflates with air by releasing beneath it bubbles brought down from the surface. The spider hangs her eggs from the ceiling and when they are hatched there is sufficient air until they can provide their own.

The actual timing of the laying of eggs presents many curiosities. Among the fishes there is an apparent synchronisation of spawning with lunar activity. The grunion (*Leuristhes tenuis*), a small fish of about seven inches in length, is found in large numbers in Pacific shore waters from San Francisco to Lower California. At the high tides from March to August great shoals of these fish make their way towards the shore. The females deposit their eggs in the sand and quickly move out to sea again. The eggs remain in the sand pockets for ten to fourteen days, by which time the embryos are ready to break out of the egg—and this is just the time of the next high tide which carries the young fish back into the sea.

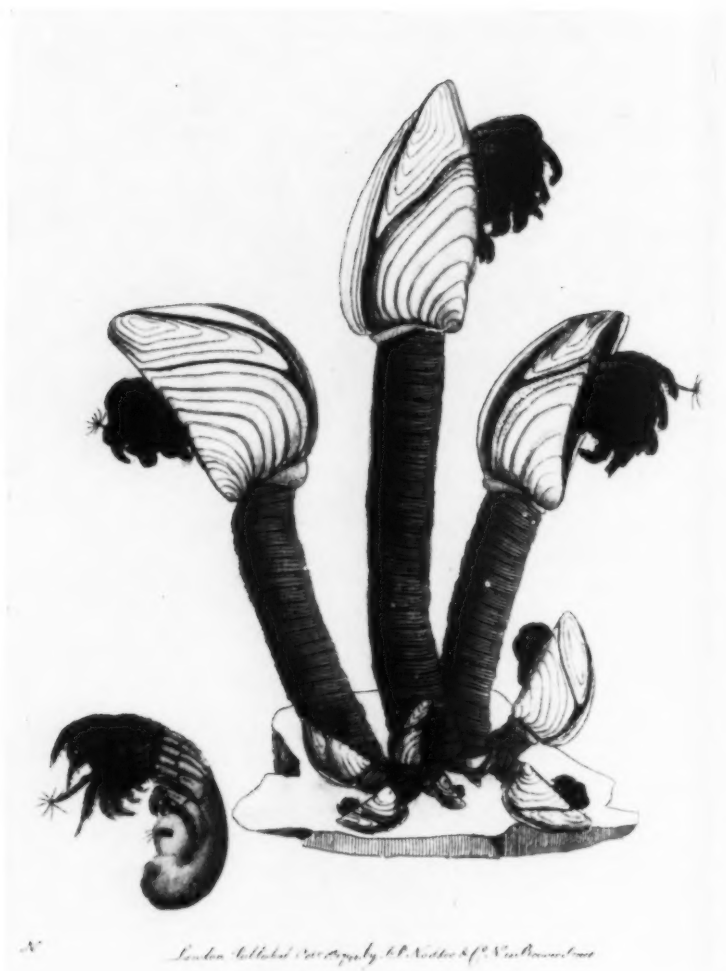


Fig. 4. An illustration of the barnacle (*Lepas anatifera*) from George Shaw's *Naturalists' Miscellany*.

A similar precise timing is found among the polychaete worms. In 1847, John Gray, then Keeper of Zoology at the British Museum, received from the Rev. J. B. Stair, a missionary in Samoa, several specimens of one of these worms known locally as the palolo. The worms appear at the surface of the sea on the day before and on the day of the third quarter of the moon in October and November. The average length is about a foot and the natives regard them as a great delicacy for eating either baked or raw. Gray reported this discovery to the Zoological Society. He was puzzled by the fact that none of the specimens he received had a head but he assumed that this was just accidental. Ten years later, J. D. Macdonald, Assistant Surgeon on H.M.S. Herald, then engaged in a survey of the south-west Pacific, wrote a further account of this worm which was published in the *Transactions of the Linnean Society* in 1858. He, too, found that the worms he obtained were headless and he suggested that this might have something to do with the mode of propagation. The polychaeta collected during the Challenger expedition of the years 1873-6 were reported on by Professor M'Intosh of the University of St. Andrews and he found only one perfect specimen of palolo. What happens is that this worm has its habitat in the deep cavernous hollows at the base of the coral reefs around Samoa, Fiji and Tonga. In October and November, the worms crawl backwards out of their burrows and as soon as the hinder part is free, the last three-quarters breaks off, leaving the head and front quarter in the hollow. The hind portion, filled with eggs or sperms, rises to the surface and bursts, scattering the contents.

There is also in this same area another example of seasonal synchronisation. Three days before the October swarming of the palolo, the local land crabs (*Gecarcinus ruricola*) set out from their normal habitat in the hills and make their way down to the sea to swarm. Nothing deflects them from their course, they surmount every obstacle and then, having laid their eggs, they set off on the long journey back again. The young pass through their normal larval stages in the sea and then they too trek inland.

The maturing of the young animal may be achieved quickly where circumstances do not favour a long protection of defenceless young; but often the parents make elaborate and prolonged provision for the care of their immature offspring. One of the cicadas, *Tibicina septendecim*, takes no less than seventeen years to attain its adult form which it enjoys for only a brief period. The type of protection adopted may take diverse forms but some of the most remarkable are to be found in the nests constructed by birds, fish and insects. One of the most ingenious of these is the nest of the tailor-bird (*Motacilla sutoria*). Thomas Pennant in his *Indian Zoology* published in 1790, points out that the birds of the tropics are conscious of "inhabiting a climate replete with enemies to them and their young; with snakes that twine up the bodies of the trees, and apes that are perpetually in search of prey; but, heaven-instructed, they elude the glidings of the one and the activity of the others. The



Fig. 5. Thomas Pennant's illustration of the nest of the tailor-bird, taken from his *Indian Zoology*.

birds are obliged to exert unusual artifice in placing their little broods out of reach of an invader." He mentions that many birds build their nests at the extremity of the slenderest twig, but the tailor-bird does even better and affixes the nest to the leaves themselves. It is composed of two leaves, sewn together by means of slender fibres. The bird uses its beak as a needle and the nest is in the form of a pouch, open at the top (Fig. 5).

A case of comparable ingenuity is found among the ants. *Oecophylla smaragdina*, common in Eastern Asia, makes shelters on the leaves of trees by curling over the edges and joining them together. The adult has no means of effecting this suture; but the larva possesses secreting glands which it normally uses for the formation of a cocoon. The adult, carrying the larva in its jaws, forces it to disgorge the sticky secretion and so unites the leaf edges.

Many fish, notably the Hassar fishes of South America and Protopterus, Gymnarchus and Heterotis of African waters, make elaborate nests, often taking many days to complete. Reeds and water-weeds are broken off, and plaited and the walls are sometimes several inches thick. Others, such as the climbing perch, use other material for this purpose. This fish has many peculiarities. It was first noted in 1791 when a Danish resident, M. Daldorff, at Tranquebar in India, one day during a rainstorm found one apparently climbing a Palmyra palm. He communicated this incident in the *Transactions of the Linnean Society* in 1797 and named the fish *Perca scandans*. Two years previously, however, in 1795, Mark Eliezer Bloch, the famous ichthyologist, formerly a physician of Berlin, had named it *Testudineus* since its integument resembled that of a turtle. Cuvier named it *Anabas*, as a member of the group possessing breathing apparatus as well as gills; but the old name still persists, the climbing perch, though it is not a perch and it is doubtful whether it does climb in the ordinary sense. What it can do, however, is not only to remain out of water for a considerable time but also to cross quite considerable stretches of land from one area of water to another apparently no more attractive than the one left behind. Its average length is six inches and Hugh M. Smith, Fisheries Adviser to the Kingdom of Thailand, observed them travelling a distance of about 300 ft. in half an hour, passing through grass, over a metalled driveway, through flower beds and so into the new pool. It is this fish that forms its nest by blowing out a froth of bubbles which settles on the surface of the water and in which the eggs are laid and hatched.

It frequently happens that the young creature is endowed with structures essential to its survival just before or after birth and which are discarded after a very brief but vital period. Among these may be mentioned the "egg-tooth," found in birds and many of the egg-laying reptiles, as well as in Monotremes. Sir Arthur Keith (*Ann. Roy. Coll. Surg.* 1951, 8, pp. 166-169) has given an account of this structure with special reference to the Hunterian specimen No. 3456, described in the catalogue as



Fig. 6. Illustration taken from Sir Arthur Keith's paper in *Annals* of February 1951.

"A series of six heads of young goslings at different stages of growth, to show the progressive development . . . of the deciduous horny knob near the extremity of the upper mandible." This protuberance serves to file through the eggshell and enables the neonatus to free itself, after which it is shed (Fig. 6).

Another transitory structure is found in the hoatzin (*Opisthocomus cristatus*), a South American bird with many peculiarities. The earliest description of it seems to have been by Francisco Hernandez in his *Rerum medicarum Novae Hispaniae Thesaurus seu plantarum, animalium, mineralium Mexicanorum Historia*, published in Rome in 1651 and he mentions that it was thought to be unlucky by the natives, though "the bones relieve wounds in every part of the human body and a fumigation of its feathers restores the mind of those who are recovering from any illness." Its skeleton presents certain similarities to that of a reptile. The capacious crop is very muscular and is in two portions, separated by a partial constriction, an unique feature which has caused this bird to be compared with the ruminants among the mammals, especially as further down the intestine it possesses what might be termed a "third stomach." The shape of the foot is particularly suited to the purely arboreal habits of the bird, for it seldom takes wing. The newly hatched young not only have the claws of the first and second digits of the wing nearly as large as in the foot, but there are smaller claws also on the third and fourth digits. These wing claws are shed after a few weeks but while they are present they enable the young bird to creep about in almost quadrupedal fashion until it is strong enough to support itself solely on its feet.

A recent observation made by A. G. Lyne when he was working in the Department of Zoology in the University of Cambridge, refers to the presence of similar deciduous claws in the young bandicoot (*Isodon obesulus*) (*Proc. Zool. Soc. Lond.* 1952, **122**, pp. 634-635). Since these claws are shed soon after the embryo reaches the pouch, it is suggested that they are developed for the sole purpose of making this journey. These findings would have had a special interest for John Hunter, for he was particularly curious about the propagation and development in that group of animals that came to be known as the Marsupials.

In 1790 there was published in London the *Journal of a Voyage to New South Wales*, written by John White, who was Surgeon-general to the settlement. He was a great admirer of Hunter who, he says, "to a sublime and inventive genius, happily unites a disinterested and generous zeal for the promotion of natural science." It may well have been White who procured the dozen or so young Kangaroos now in the Hunterian Museum, for Dr. George Shaw, author of *The Naturalist's Miscellany*, who superintended the publication of the *Journal*, mentions in its Appendix that White sent to England several specimens of "The Non-descript Animals of New South Wales." "There was no person," says Shaw, "to whom these could be given with so much propriety as Mr. Hunter . . . and it is to him that we are indebted for the following observations upon them."

Among the animals that Hunter described in this Appendix is the kangaroo and his account is interesting in that it contains some original observations but also some curious omissions. The specimens must have included some very young animals for he remarks that "they have all the marks of a foetus; no hair; ears lapped close over the head; no marks on the feet of having been used in progressive motion . . . and the sides of the mouth united something like the eyelids of a puppy just whelped having only a passage at the anterior part." He does not, however, mention the marsupial pouch, so that his information at this date must have been based on incomplete material, a supposition that is confirmed by Everard Home in his "Observations on the Mode of Generation of the Kangaroo," published in the *Philosophical Transactions of the Royal Society* in 1795. Here Home states that Hunter "applied to Captain Paterson, and Mr. Lang, a surgeon, who were going to Port Jackson . . . to procure the female organs of the kangaroo under all the different circumstances in which they occurred." By the time they arrived, however, "Mr. Hunter's time was so much occupied by his public appointments that he had not sufficient leisure to examine them"—so that the elucidation of this problem was left to Home himself.

Hunter must frequently have experienced the frustration of being in possession of insufficient material or data concerning animals such as these from "New Holland." This is shown by his introductory remarks in the Appendix mentioned above. "It is much to be wished," he says, "that those gentlemen who are desirous of obliging their friends, and

promoting the study of Natural History, by sending home specimens, would endeavour to procure all the information they can relating to such specimens as they may collect. . . . A neglect in procuring this information has left us, almost to this day, very ignorant of that part of the Natural History of animals which is the most interesting." And he goes on to say: "In collecting animals, even the name given by the natives, if possible, should be known; for a name, to a Naturalist, should mean nothing but that to which it is annexed, having no allusion to any thing else." It may be, therefore, that we are indebted indirectly to Hunter for the naming of the kangaroo for he doubtless impressed upon Sir Joseph Banks, his friend, the importance of discovering these native names. Banks was the naturalist on Cook's expedition and is credited with naming this animal "kangaroo," this being what he believed to be the word used by the Aborigines to refer to the creature. It has recently (1952) been suggested, however, that "perhaps a native cleared his throat at the critical moment and was thus unexpectedly immortalised," for no known Australian native dialect includes such a word.

THE NEW ANATOMICAL NOMENCLATURE

IN JULY OF 1955, in Paris, the Sixth International Congress of Anatomists approved a new official anatomical nomenclature. This revised list of anatomical terms differs from others issued previously in that it was compiled by an international committee and has now been accepted by anatomists for international use.

During the second half of the nineteenth century, a growing dissatisfaction with the multiplicity of anatomical terms in use prompted the first combined effort to provide a standard nomenclature, and a committee formed mainly of German-speaking anatomists drew up the list of terms known as the Basle *Nomina Anatomica*, more usually referred to as B.N.A. (1895). As an international anatomical language it met with varied acceptance. In Britain its adoption was gradual, by 1933 a definitive attitude towards it had been reached, and in that year a British Revision of the Basle *Nomina Anatomica* was published by the Anatomical Society of Great Britain and Ireland. At about the same time a German revision known as the Jena *Nomina Anatomica* was also issued. In addition, American anatomists, who had originally accepted the B.N.A. (1895), drew up a separate list. It should be made clear, however, that the work of the Basle N.A. Committee had been well done and that these were revisions, not wholesale replacements.

The first truly international committee to consider the matter was appointed in 1936 by the Fourth International Congress of Anatomists meeting at Milan, but its work was interrupted by the Second World War and it was not until 1950, when the Fifth International Congress

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met at Oxford that the matter was taken up again. An International Anatomical Nomenclature Committee was set up, and the work of this Committee resulted in the Paris *Nomina Anatomica* of 1955. Although certain anatomical bodies were not represented on the Committee—notably those of India and Russia—it is to be hoped that this will be the last major revision and that it will be used, in time, locally as well as internationally.

In these days the advantages of a common language in a descriptive subject are obvious, and should eventually benefit other fields of medicine besides Anatomy. Naturally, it could not be evolved without the alteration of some current British terms, but major changes are few. One or two structures familiar in clinical practice are, however, affected. The circumflex nerve, for example, is now the axillary nerve, even though it quickly leaves the axilla and though its accompanying artery is still called the posterior humeral circumflex artery. The internal mammary artery becomes the internal thoracic artery. The accessory nerve, which has always been a little troublesome, is now described as having an internal branch (cranial part), and an external branch (spinal part). The moderator band of the right ventricle is to be known officially as the trabecula septomarginalis, and certain details of the heart valves are changed—why, one is not very sure. At present, in British textbooks, it is usual to name the cusps of the pulmonary valve posterior, right, and left; in the new list they are given as anterior, right, and left. Similarly the cusps of the aortic valve have been changed from anterior, right, and left to posterior, right and left. One feels, also, that there is a lack of uniformity about the terms used for the mitral and tricuspid valves. In the former, the cusps are named anterior and posterior, in the latter, ventral, dorsal and septal. The nerve to serratus anterior, like the circumflex and accessory nerves, reverts to its original B.N.A. form of long thoracic nerve, and the radial nerve is described as ending above the elbow joint by dividing into a superficial and a deep branch.

The addition of new terms is seen in the central nervous system and in the naming of the broncho-pulmonary segments, where the anatomists have recognised and followed the work of the clinicians in this special field. A similar recognition is made with regard to that part of the uterus known to obstetricians as the lower uterine segment. Its official anatomical name is now isthmus uteri.

As before, this latest official nomenclature is set out in Latin, but the Committee has taken the precaution of disarming pedantic criticism by putting on record . . . "that it was not desirable to lay stress on the etymological aspects of anatomical terminology," and that . . . "on most questions of spelling, gender, etc., the Committee has usually chosen to accept established usage." Where translation from the Latin is desirable—the names of muscles are almost all carried directly over into English—the Committee recognises that some latitude must be allowed to the

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vernacular, and one awaits with interest the English term for the new name of the eighth cranial nerve—*nervus stato-acusticus*. No attempt has been made to establish a terminology for histology or embryology, and again, as in previous lists, eponyms have been deliberately omitted.

An opportunity to approve changes or additions will be given each five years at the International Congresses, and there has been a suggestion that a permanent Committee on Nomenclature would be helpful. To meet local circumstances, the publication in the standard textbooks of a glossary of the new terms, as was done after the British revision of 1933, would seem to be desirable and adequate.

The point which struck the present writer more than any other as he read through the new nomenclature was that a name has now been found for the Artery Without a Name. One has often wondered why a vessel which supplies one-eighth, let us say, of the body with blood should have been called the innominate artery, or, what sounds even more casual to English ears, the B.N.A. (1895) term—*Arteria Anonyma*. Now it is to be called the brachio-cephalic trunk—not an elegant name perhaps but at any rate, “*nomen proprium*,” a name of its own. And so, however much the old deplore the passing of Poupart and Magendie, Santorini and Vesalius, and the young complain during the years of change-over, and the cynics whisper that it does not much matter what things are called as long as everyone calls them the same—while all these may be, one feels that with the introduction of *Nomina Anatomica*, Paris, 1955, and the granting of a name to the innominate artery, at least one long-standing wrong has been righted.

R.M.L.

COLLEGE PUBLICATIONS

READERS ARE REMINDED that the following publications issued or sponsored by the College may be obtained from the Editorial Secretary, Royal College of Surgeons of England, Lincoln's Inn Fields, London, W.C.2.

Lives of the Fellows, 1930-1951. By the late Sir D'Arcy Power, K.B.E., F.R.C.S., Honorary Librarian, and continued by W. R. Le Fanu, M.A., Librarian. A single volume, bound in blue cloth, of 889 pages, containing the Lives of all Fellows known to have died between 1930 and 1951. £2 2s. 0d. post free.

A Record of the Years from 1901 to 1950. Edited by Sir Ernest Finch, M.D., M.S., F.R.C.S. A slim volume, illustrated, containing a brief history of the College between the centenary and the 150th anniversary of the foundation with lives of all the Presidents since 1900, written by special contributors from their personal knowledge. In red cloth 9s. post free or red paper covers 5s. 6d. post free.

John Hunter, a List of his Books. A short-title bibliography of all known editions of John Hunter's books, compiled by the Librarian. Printed at the Cambridge University Press, and bound in green cloth. 2s. 6d. post free.

**William Clift.* By Jessie Dobson, B.A., M.Sc., Anatomy Curator. A new biography, fully illustrated, of the first Conservator of the Museum at the College. Published by William Heinemann Medical Books Ltd. Bound in blue cloth; 144 pages with frontispiece portrait and 31 plates. 8s. 6d. post free.

*A separate cheque for this publication would be appreciated.

SIR GORDON GORDON-TAYLOR: AN APPRECIATION*

' Miseris succurrere disco '

. I am learning to succour the distressed

HOW WONDERFULLY HAVE the Middlesex Hospital and Medical School fulfilled the above motto with regard to the patients, medical students and student nurses, since it was suggested by Dr. William Cayley who was one of the honorary physicians from 1870 to 1891. The Institution "for the sick and lame of Soho" later to become the Middlesex Hospital was opened in 1745. It was an age of philanthropy; in the preceding twenty years four of the "teaching hospitals" in London were founded by private citizens who supported them by voluntary efforts and subscriptions. In 1747 the Middlesex Hospital became the first lying-in hospital in England. In 1791 the first hospital wards in this country were established for cancer patients by the "Cancer Charity" which was organised by the staff of the hospital, with the financial help of Mr. Samuel Whitbread. The terms of the Charity were "That patients labouring under cancer



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Sir Gordon Gordon-Taylor, with the portrait which was presented to him on the night of 27th March, at the Middlesex Hospital. With him is the artist, Miss Anna Zinkeisen.

* *British Journal of Surgery*. Special Gordon-Taylor Birthday Number published 18th March 1958. John Wright & Sons Ltd. (Bristol). Price 21s.

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requiring operation, spreading ulcerating cancers and cancers recurring after operations, shall remain an unlimited time until either relieved by art or released by death." The result has been that the surgeons of this hospital have always had great experience in the operative treatment of malignant disease.

From time to time the Editorial Board of the *British Journal of Surgery* has dedicated one of the numbers to a surgeon who has deserved this distinction by his knowledge, surgical judgment and technical ability, personality, singleness of purpose, leadership and the inspiration he has afforded to his colleagues and students. Such an one is Sir Gordon Gordon-Taylor, so the April number for 1949 (Vol. XXXVI No. 144) was dedicated to him. The editorial in this number begins "It is given to few men to realize the esteem in which they are held by their fellows. The self-satisfied may be deceived by the respect accorded to their seniority or status, but the truly great are often insensible of the pride which others take in their achievement."

In 1898 Gordon-Taylor, already a M.A. of the University of Aberdeen, gained a scholarship to the Middlesex Hospital. He qualified in 1903 at the University of London having obtained an exhibition and the gold medal in anatomy. He fulfilled the resident posts at the Middlesex of house surgeon, casualty surgical officer and resident medical officer. He also worked as a demonstrator of anatomy under Professor Peter Thompson.

In 1903 the University of London instituted a B.Sc. degree in anatomy. The only two candidates who offered themselves were two young men, friends and colleagues at the Middlesex; Gordon Gordon-Taylor and the late Victor Bonney. It is recorded that as they were busy hospital residents they decided to work through the night three times a week, refreshing themselves with coffee made with essence heated by a bunsen burner, until 5 a.m. when they had something to eat in the hospital and gained what sleep they could. Both achieved first class honours.

"The heights by great men reached and kept
Were not attained by sudden flight,
But they, while their companions slept,
Were toiling upward in the night."

To be the recipient of a dedicated number of the *British Journal of Surgery* is a very great honour, but to have two is at present unique. On 18th March last Sir Gordon Gordon-Taylor attained his eightieth birthday and on that morning he found on his breakfast table a "special Gordon-Taylor Birthday number of the *British Journal of Surgery* (Vol. XLV No. 193)" compiled by his colleagues on the staff of the Middlesex, his past students, his friends and admirers in this country and the Commonwealth. In addition he received greetings telegrams, cables and letters from all parts of the world. The editorial in the birthday number states "Sir Gordon has travelled to most parts of the world and is *au fait* with the

problems which face the rising generations of surgeons. His second surgical home is perhaps in Australia, for he worked with many surgeons from Australia and New Zealand in the first world war in France, since when he has kept in touch with them and their surgical sons. The Gordon-Taylor prize for the best candidate in the Australian Primary Fellowship Examination is the most coveted of all the surgical prizes in Australia, and no wonder !” The Sir Gordon Gordon-Taylor prize for the Australasian Primary Fellowship Examination was endowed on 1st December 1949 by five Australians who had been awarded the Hallett prize in the English Primary Fellowship Examination. He was Acting Consultant Surgeon to the 4th Army B.E.F. in the war of 1914-18. The Royal Navy were fortunate in the second world war (1939-45) that, on account of regulations concerning age, the Army were unable to employ him, so he was appointed Consultant Surgeon to the Royal Navy with the temporary rank of a Surgeon Rear-Admiral.

His singleness of mind and purpose is illustrated by his devotion to anatomy which is the foundation of all surgical technique. He has examined for the Royal College of Surgeons in anatomy in this country, Australia, New Zealand, Egypt, India and Ceylon. He has been a most valuable contributor to the *British Journal of Surgery* since its inception in 1913. All surgeons would be wise to read every article he has written no matter what the particular subject. If the subject does not immediately appeal to them in their particular work, they could not fail to learn much on how to present a theme and appreciate the beautiful English with which it is expressed both as to content, breadth of knowledge, work and thought. The way the subject is epitomised reflects the advantage of the author's classical education.

The Birthday Number opens with a photograph of Sir Gordon's portrait presented by his colleagues and friends of the Middlesex and painted by Miss Anna Zinkeisen who, during the last war, worked as a nurse at St. Mary's Hospital and also acted as the hospital artist. This portrait was presented to him at a “homely” ceremony at the Middlesex during the evening of Thursday 27th March which was attended by the artist. The dedicated number of the *British Journal of Surgery* for April 1949 also opens with a photograph. The white carnation in the button-hole in both portrait and photograph is obvious. A carnation is also in this position in a photograph taken almost fifty years ago, in fact the only occasion when he has not worn a carnation must have been during a dress parade while in the services. It would surprise no one to learn that some horticulturist had evolved a special variety of carnation and named it after him.

The photograph of the portrait in the Birthday number when compared with that in the April 1949 number shows him as an older man but even so, like the latest portrait of Joseph Lord Lister, it also shows how kindly,

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wise, courteous and gracious he has remained. The words of Laurence Binyon, slightly altered, immediately come to mind :

“ He has not grown old as others grow old
Age has not wearied him nor the years condemned.”

His contributions to surgery by the written and spoken word have dealt, so properly for a Middlesex Hospital surgeon, with the diagnosis,



Reproduced by kind permission of Miss Anna Zinkelsen.

Sir Gordon Gordon-Taylor, K.B.E., C.B., LL.D.(Camb.), F.R.C.S.

pathology and treatment of cancer in its various forms but more especially with that occurring in bone, oesophagus and abdomen. He will always be remembered as the great protagonist of the hind-quarter amputation. Twenty-six years ago G. G.-T., as he is known to all his surgical colleagues and friends, when proposing the health of another surgeon, with similar

surgical interests as himself, enumerated the qualities necessary for a good "cancer surgeon." He said that "such an one needed temperance, fortitude, courage, hope, the wisdom of a serpent, a heart of gold and the modesty of a vestal virgin." Could his own qualities be better described?

The twenty-five articles in the Special Birthday Number will all bear careful study. It would be invidious to criticise them, but as G. G.-T. reads them he will find that they reflect his own teaching and perhaps some of his idiosyncrasies and expressions which have made him so endeared and attractive to his colleagues, house surgeons and dressers. He has been a wonderful mixer and on his ambassadorial trips to the Commonwealth he has preferred to take up his quarters in the hospitals and eschew the luxury hotels and clubs. A young Australian surgeon, when asked if he knew G. G.-T., replied "Know him? Of course! he used to have breakfast with us residents and also sit up with us yarning and teaching us until the early hours." It is this quality that has made him so valuable to the Royal College of Surgeons as Sub-Dean of the Institute of Basic Medical Sciences since he was appointed in 1950. What have others in the surgical world thought of G. G.-T.? First of all it is of the utmost importance to all aspiring to the vocation of surgery, what examiners and those on the staff of one's teaching hospital think. He obtained both the diploma of F.R.C.S. and the degree of M.S. (London) in 1906.

He was appointed Assistant Surgeon to the Middlesex in 1907 and full Surgeon in 1920. Between 1941 and 1952 he received a Doctorate (Honoris Causa) from the Universities of Toronto, Montreal, Athens and Cambridge. His worth has been recognised in the Birthday and New Year Honours by being awarded the O.B.E. (1919), C.B. (1942) and K.B.E. (1946). He was made Commander of the Legion of Merit U.S.A. (1946). He has been a Hunterian Professor at the Royal College of Surgeons on three occasions: Moseley Professor of Surgery in 1941 and 1946 at the Peter Bent Brigham Hospital, Harvard University; a member of the Council of the Royal College of Surgeons (1932-1948) and Vice-President (1941-1943). He has been an examiner in Surgery at the Universities of Cambridge, London, Belfast, Leeds, Durham, Edinburgh and Sheffield. He has undertaken many missions as an ambassador for the College to Canada, America and Australia. During the late war, on behalf of the President and Council, he conferred Honorary Fellowships of the College on surgeons in Moscow and Cairo; rumour has it that these were conferred respectively in Russian and Arabic. He himself has received the Honorary Fellowship of the Colleges of Surgeons of Australia, America, Canada, Edinburgh and Ireland. When presented by the Secretary of the Council to the President of the Irish College on 14th February, 1953, reference was made to his worthiness to be the most recent successor to the first Honorary Fellow who was John Hunter and to the fact that Sir Patrick Dun, also a graduate of the University of Aberdeen, seat of Britain's oldest Medical Faculty (1494), had founded the first School of Anatomy in Dublin (1711).

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He has been made an Honorary Member of many British and Foreign Medical and Surgical Societies including those of London, France, Belgium, Greece and Lyons. He was President of the Royal Society of Medicine of London (1944-1946), made an Honorary Fellow (1949), and awarded the Gold Medal of the Society (1956); he is only the second surgeon to have received this honour, the first being the late Wilfred Trotter. His knowledge of the history of surgery has led to many requests from Universities, Colleges and Societies to give memorial lectures. These include the Moseley lecture at Toronto (1938) on "Abdominal Injuries and their Recipients"; the first Moynihan lecture at Leeds (1940) on "The Moynihan Tradition"; the Bradshaw lecture at the Royal College of Surgeons (1942) on "The Abdominal Surgery of Total War"; the Lettsomian lectures at the Medical Society of London (1945) on "The present position of Surgery in the treatment of Bleeding Peptic Ulcer"; the George Adlington Syme Oration at the Royal Australasian College of Surgeons (1947) on "The Debt of Surgical Science to Australasia"; the Sheen Memorial lecture at Cardiff (1949) on "The Surgery of the Innominate Artery with special reference to Aneurysm"; the Rutherford Morison lecture at Newcastle upon Tyne (1953) on "The Rutherford Morison Tradition" commemorating the centenary of his birth, October, 1853. He has given the Thomas Vicary lecture at the Royal College of Surgeons on two occasions (1945 and 1954), the titles of both illustrate his pride in his native Scotland; in 1945 he spoke on "The Medical and Surgical Aspects of the Forty-five" and in 1954 "The Life and Times of Sir Charles Bell." He was Vice-President of the International Society of Surgery when it met in London in 1947 under the Presidency of the late Professor George Grey Turner.

In 1952 the President and Council of the Royal College of Surgeons set up a plaque in the Church of St. Martin-in-the-Fields to commemorate the fact that the body of John Hunter had rested there in the crypt from 1793 to 1856 when by the efforts of Frank Buckland it was moved to Westminster Abbey "that temple of silence and reconciliation where the enmities of twenty generations lie buried." Sir Gordon Gordon-Taylor gave a memorable address worthy of any Hunterian Orator after the plaque had been unveiled by Sir Henry Dale and dedicated by the Dean of Westminster.

Many of his contributions to the *British Journal of Surgery*, during the war years and after, deal with abdominal injuries sustained in warfare, one of the best known being "The Last Hate," an account of the Abdominal Injuries of the V 1 and V 2 phases of the war on Britain and the shelling of Dover (1946, Vol. xxxiii, No. 131, 230).

The books he has written include *The Dramatic in Surgery* and *The Abdominal Injuries of Warfare*. In 1944-1945 Sir Gordon Gordon-Taylor was President of the Association of Surgeons of Great Britain and Ireland.

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To no President has the citation been more applicable when recited by his predecessor as he places the collar of office on the new President :

‘ Mr. President :

I place upon your shoulders
The Badge of Honour
The Emblem of Leadership
The Reward of Service
A tribute from your colleagues.’

Sir Gordon Gordon-Taylor is the only surgeon of Great Britain and Ireland who has been honoured by the Association by having been elected an Honorary Fellow.

E.F.

DIPLOMA-GRANTING CEREMONY

THE COUNCIL HAS decided to institute an annual ceremony for the presentation of diplomas which will take place on the day before the June meeting of the Council—11th June 1958 at 2.30 p.m. on the first occasion.

The occasion will be a general meeting of the College open to Fellows, Members and other diplomates of the College, and in the presence of this general meeting there will be a meeting of the Council at which Honorary Fellows and Elected Fellows will be admitted and diplomas will be granted to the candidates successful at the Final Fellowship Examination in May. The Honorary Fellows to be admitted on this occasion will be Professor C. F. W. Illingworth, C.B.E., of Glasgow and Professor F. L. P. de G. d’Allaines of Paris.

The Fellows, Members, Fellows and Licentiates in Dental Surgery and Fellows in the Faculty of Anaesthetists who have indicated a wish to attend the ceremony will be presented according to their medical school by a member of Council or Court of Examiners or appropriate Board of Faculty, and will individually receive their diplomas from the President.

A short address will be delivered.

Every effort is being made to render this ceremony impressive and dignified. Fellows and other diplomates are most welcome to attend. It is hoped that all who possess the academical dress of the College will wear it, but this is not obligatory.

APPOINTMENT OF FELLOWS AND MEMBERS TO CONSULTANT POSTS

J. R. H. PINKERTON, M.A., M.D., Consultant Pathologist to the Boston (Lincolnshire) Group of Hospitals.
B.CHIR., F.R.C.S.

H. B. ECKSTEIN, F.R.C.S. Paediatric Surgeon to Ankara University.

The Editor is always glad to receive details of new appointments obtained by Fellows and Members, either through the Hospital Boards or direct.

THE LISTER FESTIVAL

THE LISTERIAN FESTIVAL was held this year on Friday, 28th March, as Lord Lister's birthday (5th April) fell on a Saturday.

The Lister Oration was delivered in the afternoon by Sir Stewart Duke-Elder, G.C.V.O., F.R.C.S., who took as his subject "The emergence of vision in the Animal World." This will be reported in a later number of the Annals.

At the Listerian Festival Dinner the chair was taken by the President (Professor Sir James Paterson Ross, K.C.V.O.) and the company numbered 120.

The principal guests, in addition to the speakers, included the French Ambassador, the High Commissioner for Australia, the Mayor of Westminster, the Vice-Chancellor and Principal of the University of London, six Presidents of kindred institutions, two members of the Court of Patrons (Sir Simon Marks and Sir Henry Dale) and other distinguished visitors.



The President welcoming Sir Stewart Duke-Elder, G.C.V.O., who gave the Lister Oration earlier in the day, to the Listerian Festival Dinner.

The toast of the College was proposed by the Rt. Hon. Viscount Crookshank, who thanked his hosts for an intellectual and gastronomic treat. As a Trustee of the Hunterian Collection, a past Minister of Health and one who had visited the College on many occasions he had an intimate knowledge of it, but felt that it was not so well known to the public as it

THE LISTER FESTIVAL

should be. There was no reason, he said, why surgeons should subject the College to the reticence and modesty which they showed about themselves and their own work, but they might do much to improve the public relations of the College. Surgery was of the utmost importance to mankind, and in England it was something of which the public could be proud indeed.

The President, having thanked Lord Crookshank, spoke of John Hunter and Joseph Lister as the greatest of our forefathers.

"Hunter, by applying the experimental method, had established himself as the father of scientific surgery, and added vast stores of physiological and pathological knowledge to that of anatomy, but in his day surgery was a dangerous business till Lister by introducing antiseptics made surgery safe for the patient.

"It was not till physiologists showed us how the body reacted to surgical operations, and how the body's reserves could be built up before-hand that the patient was made safe for surgery. It therefore became necessary for surgeons to learn a great deal about physiology, and more recently pharmacology also had come to take its part in the surgeon's education.

"This College had been constantly mindful of its duty to promote the science and art of surgery, and its Court of Examiners had set its standards to conform to the most recent advances in surgery. Candidates came from all over the Commonwealth to take the higher diplomas of this College, and the standards set here benefit countless people all over the world.

"If Lister could revisit the College he would be bewildered at first by its intense activity, but would readily understand that it is our duty to provide what amounts to an honours course in the basic medical sciences for the large numbers of postgraduates who wish to prepare themselves for the first examinations for the higher diplomas in surgery, dental surgery, anaesthetics, obstetrics and gynaecology, ophthalmology, otolaryngology and other specialties. He would understand to the full the advantages which our teaching departments enjoy through our association with the University of London, and would approve our desire that all our teaching departments, including the Department of Pharmacology, should be thus intimately linked with the University and that the heads of these departments, again including Pharmacology, should become Appointed Teachers in the University as well as being Professors in this College.

"How interested he would be in our research work into the problems of modern anaesthesia : into the mechanisms of wound healing : into several aspects of dental disease : into the building up and breaking down of fats in the body, which may be of great importance in certain degenerative processes (heart and arteries) : into the minute structure of cells, by means of electron microscopy : and into the production of cancer in animals and the study of cancer in man. He would know that a teaching department cannot thrive unless members of the staff are given the opportunity to advance their subject by research, and he would see that the subjects being studied all have a direct bearing upon the problems arising in the care of sick people.

"All this activity requires more accommodation, and more equipment, and you must all know that we are continuing to rebuild the College. This is an enormous undertaking but we are fortunate in having many friends who believe in our cause and to whom we are deeply indebted for their encouragement as well as for their material help—friends such as Sir Simon Marks and his family and his colleagues : the Wellcome Trust, the Leverhulme Trust, the British Oxygen Company, and Imperial Chemical Industries : Lord Nuffield, after whom the Residential College is named : and Mr. Edward Lumley who is to us

THE LISTER FESTIVAL

an old friend and a wise counsellor. We are deeply grateful for the good will towards the College which exists in the world of Industry, Commerce and Finance.

"It has been said that we are *overambitious* and that it is for that reason we have to appeal to our friends for help. The answer to that lies in our history and in our heritage. The prestige of the College is such that there is no need for it to build unto itself greater barns merely with a view to self-aggrandisement.

"On the other hand if we are to live up to our heritage we must be prepared to shoulder our proper responsibilities, however burdensome they may be. And we as surgeons believe that in undertaking this task we are doing no more than our bare duty to these postgraduate students, to our profession, and ultimately to our patients."

Sir Archibald McIndoe (Vice-President) sang the praises of the Listerian Orator in no uncertain terms, describing him as a worthy successor to those who had previously won the distinction of the Lister Medal—an award given only to the world's best. He traced the meteoric career of this energetic Scot, now well known in whatever part of the world one might travel—a man of great intellect and charm, provocative and never dull.

Sir Stewart Duke-Elder, replying to the toast, commended the custom of celebrating the famous men of the past whether by the erection of statues or by dining together in commemoration. He expressed great appreciation of the honour paid to him, which he particularly welcomed for Ophthalmology, the oldest of the specialties. As he stood facing the portrait of Lister, he felt that the spirit of Lister was becoming more and more alive in the College.

Sir Russell Brock (Vice-President) proposed the toast of the guests and humorously reassured his hearers that they would not need to suffer the customary list of distinguished names and important offices and surmised that the senior guests could not wish to hear their virtues yet again. He divided the visitors into two groups, medical and non-medical, and welcomed all with warmth, adding a few special words of pleasure for the Australians and their country.

Sir Charles Wheeler (President of the Royal Academy) seemed particularly happy to associate himself, a sculptor, with surgeons. He told of a man carving a canoe out of a tree trunk, who cut away so much that it had to become a paddle, and then again he cut away so much that it had to become a spoon. Was Surgery like this? If so, the human body would soon become like some modern sculpture—always a hole through it. A more serious link between sculpture and the medical profession was William Hunter, who for many years had been Professor of Anatomy to the Royal Academy. "What a piece of work is man! (he quoted) in action how like an angel! in apprehension how like a god! the beauty of the world! the paragon of animals!" Differences in art show the difference between the ordinary and the genius. He hailed Lister as a genius and saluted the genius of Surgery.

**ADMISSION TO THE HONORARY FELLOWSHIP OF
PROFESSOR C. CRAFOORD
OF THE UNIVERSITY OF STOCKHOLM**

SIR CLEMENT PRICE THOMAS delivered the following citation when presenting Professor C. Crafoord, Professor of Thoracic Surgery in the University of Stockholm, to the President on the occasion of his admission to the Honorary Fellowship of the College on Thursday, 13th March, 1958, during the meeting of Council.

MR. PRESIDENT AND MEMBERS OF COUNCIL :

Professor Clarence Crafoord is so well-known to all of us that any words of mine are unnecessary, except perhaps to remind you of his distinction both as a man and as a surgeon.

As a man, he is one who radiates friendliness, and in consequence, inimitable globe trotter that he is, he is always met in any country he visits by a host of devoted friends.

As a surgeon, he has always had a wide horizon and his catholic interests are mirrored in his publications. His chief interest, however, has been in intrathoracic disease, and his greatest contributions have been in the field of cardiovascular surgery.

The first amongst the hundred contributions he has made to scientific literature, published in 1928, was to report two cases operated upon for massive pulmonary embolism.

He continued his interest in thrombo-embolic disease, and immediately heparin was chemically isolated by one of his fellow countrymen he commenced an intense clinical investigation into its use, and he published a paper on his preliminary observations on the use of heparin in 1937.

During the intervening time, he had not been idle—idleness is certainly not one of his characteristics—he had been working on the problem of anaesthesia. He put on a firm scientific basis the principle of what he termed rhythmic ventilation and perfected the anaesthetic machine which was first devised by his old chief, Professor Giertz, to whom Crafoord was very devoted. This work formed the basis of all modern anaesthesia.

He performed the first operation for coarctation of the aorta in 1944, and, in so doing, gave a real impetus to the dawning interest in cardiac surgery, which has been, and is now, his chief concern.

Clarence has been honoured in many lands. He has received the degree (*honoris causa*) of M.D. from five foreign universities. He is an Honorary Fellow of the American College of Surgeons and an Honorary Fellow or Member of a score of foreign scientific societies.

He was the recipient of the Leriche Medal of the International Society of Surgery, and is, at present, the President of the European Cardio-Vascular Society.

He is held in equally high regard in his own country. The celebration of his fiftieth birthday was almost unique in that he was the recipient at the hands of his Sovereign of the gift of a large sum of money, which had

ADMISSION TO THE HONORARY FELLOWSHIP

been publicly subscribed on a nation wide basis for him to use in any way he wished. Knowing Clarence, one is not surprised that he is using the gift to further his research projects.

Mr. President, I am sure I am speaking both for you and your Council in warmly welcoming Clarence Crafoord amongst us, and I would like to thank you, sir, for the privilege of presenting him, a friend of a quarter of a century, to you to receive at your hands, the Honorary Fellowship of this, our College.

LETTERS OF ABERNETHY

THREE AUTOGRAPH LETTERS of the famous Bart's surgeon John Abernethy, President of the College in 1826, have been generously presented to the College Library. The first was given by Dr. C. W. Shepherd of Cardiff through the good offices of Professor Lambert Rogers; the other two were sent to the President by Mr. J. Law Adam, F.R.C.S. They are:

17th March, 1807, to Mr. Reece, surgeon, Cardiff; quoting William Hunter's famous paper of 1783 "on the uncertainty of the signs of murder in the case of bastard children."

23rd July, 1817, thanking the Master and Court of Assistants of the College for their "public Approbation of my *endeavours* to discharge the duties of an arduous Office"—presumably the Hunterian Professorship of Surgery which he held 1814-1817.

1st July, 1830 to the President and Council of the College resigning the seat in the Council to which he had been elected in 1810, on account of "the state of my health." Abernethy died early in 1831.

DONATIONS

THE FOLLOWING GENEROUS donations have been received during the last month:

Endowment of a Chair in Anaesthesia:

Ten-year Covenant for £15,000 p.a. British Oxygen Company Ltd.

Down House:

£1,662 16s. 6d. Sir Charles Darwin (from various members of the family).

£500 Glaxo Charity Trust.

£250 N. M. Rothschild & Sons.

General Fund:

£100 Mrs. Dyke (*per* Professor Milnes Walker).

LIFE OF SIR GEORGE BUCKSTON BROWNE, F.R.C.S.

A BIOGRAPHY HAS been written of Sir George Buckston Browne, one of the greatest benefactors the College has had, by Miss Jessie Dobson, B.A. M.Sc., and Sir Cecil Wakeley, Bt., K.B.E., C.B., LL.D., F.R.C.S. The publishers are Messrs. E. & S. Livingstone and the price of the book is 25s. net.

In Memoriam

ARTHUR W. ALLEN, F.R.C.S.(Hon.)

(1887-1958)

by

Gordon Gordon-Taylor

THE DEATH OF Arthur Allen, known to his intimates as "Jimmy Allen," has removed one who was not only immensely proud of his Honorary Fellowship, but very interested in all the affairs of the English College.

He was a Kentucky man, having been born in McKinney, Kentucky, on 30th November 1887; at the time of his death on 18th March he was therefore little more than seventy years of age. Graduating from Georgetown College, Kentucky, in 1909 he obtained his M.D. from Johns Hopkins in 1913, becoming influenced early by the work and teaching of Halsted and Cushing.

He next became associated with the Massachusetts General Hospital, which he served actively till 1948, subsequently becoming Consultant in Surgery and later Honorary Surgeon and Trustee of the hospital.

The continuity of his long years of service to the Massachusetts General Hospital was interrupted by his participation in the First Great War, during which he served in a forward surgical unit in France.

Almost every surgical honour descended upon him: in addition to the Honorary Fellowship of our own College he was an Honorary Fellow of the Edinburgh College. He was both a Hunterian Professor and a Moynihan Lecturer: President of the American College of Surgeons from 1947-48 and Chairman of the Board of Regents from 1948-51. The distinction of receiving the Bigelow Medal also belonged to him.

His chief surgical interests were in the abdomen, and he was one of the early surgeons to interest himself in the surgical treatment of ulcer haemorrhage, and, as befitted one who worked in the Massachusetts General Hospital, the institution associated with the labours of Smithwick, J. C. White and McKatrick, he had also an interest in neurovascular surgery.

I had the honour of Arthur Allen's friendship for twenty years, a friendship which commenced at a dinner in the Harvard Club in Boston with himself, Churchill, David Cheever and others. He radiated happiness and kindness, perhaps especially to the young surgeons of the Commonwealth travelling homewards across the United States to Australia and New Zealand. No one did more than he to cement the bonds of friendship between the surgeons of the English-speaking countries on each side of the Atlantic.

SOME HAPPY MEMORIES

by

Alfred Webb-Johnson

FAREWELL, DEAR FRIEND—Arthur by birth-name but “Jimmy” for short, and “Jimmy” for love.

In the forefront of my memory of Arthur is how he always saw the cheery side of things, and laughed heartily when teased.

So I publish photographs of jolly occasions, but bear in mind that *au fond* Arthur was Leader, Teacher, Master of his Art and Craft, Friend and loyal Colleague, ready to give encouragement and a helping hand.

‘He faltered neither more nor less—In his great task of happiness.’

Arthur took his place in the front rank and served Massachusetts General Hospital faithfully for over forty years.



Dr. Arthur Allen, Lord Webb-Johnson and
Dr. Henry Cave.

In our friendship, good fortune often seemed to be on our side. For example, early in our intimacy “Jimmy” and Vida were dining with us, and “Jimmy” remarked that his fondest wish was to have a week’s salmon-fishing on the Dee, but he feared that this wish would never be fulfilled. As it happened, I had met a pal that very afternoon who was lamenting that he had leased a stretch of the Dee and unfortunately could not get away.

After a few moments, I asked to be excused from the table. I rang up my friend, and he promptly invited the Allens to be his guests and said he would make arrangements. A little later I was called to the telephone.

SOME HAPPY MEMORIES

I quietly returned to the table and, to everyone's surprise, reported that everything was arranged—sleepers to Aberdeen, a week's fishing for "Jimmy",—a stay on glorious Deeside for Vida, and rooms at the hotel. "Jimmy" nearly got up to kiss me, but fortunately was forestalled by Vida.

We who mourn to-day reach out hand-grips of sympathy to "Jimmy's" faithful life's companion, whose sterling worth he knew so well :

"Steel-true and blade-straight,
The Great Artificer
Made my mate."



Dr. Arthur Allen, Mrs. Allen, Lady Webb-Johnson and Lord Webb-Johnson.

Arthur and I had many official contacts, but I recall most vividly and with the greatest pride the time when he, as President of the American College, led a band of Master Surgeons of America who came with warm and generous hearts to show their sympathy with the Royal College of Surgeons of England as they had done in many ways ever since the disaster of 1941. As President of the English College I had the honour of welcoming Arthur Allen and his colleagues—and what a joyous occasion it was ! 'Tis now ten and a half years ago !

SOME HAPPY MEMORIES

As we stood together as brothers on that historic day we were deeply moved as we were reminded of our common aims and ideals. We felt that the inspiration of our meeting would help to cement for all time the firmness of the friendship between our Colleges and our Countries.

The American College had been full of generosity in every way, and had given us a Lecture Table and Lectern as permanent tokens of their feelings. They had been wonderfully generous, but—"What had we to give them back whose worth would counterpoise their rich and precious gifts?"

Our recompense was thanks, and that might have been all, had we not held in Trust some unique and Treasured Tokens and exclusive Emblems of Merit—and what a splendid galaxy of worthy recipients were in proud array before us: men of outstanding merit and surgical ability. Truly "He hath given men skill that He might be honoured in His marvellous works"—the Lister Medal to Evarts Graham, the Honorary Medal of the College to Gallie of Toronto; and Arthur Allen at the head of half a dozen Master Surgeons to be made Honorary Fellows of our College—the President himself; Irvin Abell; Frank Lahey; Dallas Burton Phemister; and Alfred Blalock.

We had inspiring lectures from Arthur Allen, from Evarts Graham and from Frank Lahey.

"Jimmy" gave a Moynihan Lecture on what he called "Du-odd-enal Ulcer." The Festival Dinner that followed gave me the opportunity, in thanking "Jimmy" for his lecture, to tease him by telling him that we, in our country, had never seen the condition which he had described to us—nor indeed had we ever heard of it until that very day.

It is only very seldom that a surgeon from another country delivers more than one Lecture of Honour in our College, but "Jimmy" came back to us in 1950 as Hunterian Professor—to which Honour he was eligible to be elected because he was an Honorary Fellow of the College:

"Let us now praise famous men, and our fathers that begat us."

"The Lord hath wrought great glory by them through His power from the beginning."

"Leaders of the people by their counsels, and by their knowledge of learning meet for the people, wise and eloquent in their instructions."

"All these were honoured in their generations, and were the glory of their times."

And among the most elect of them was Arthur Allen of the Massachusetts General Hospital.

ANATOMICAL MUSEUM

THE SPECIAL DISPLAY for the month of May consists of Hunterian specimens illustrating the nervous system.

PROCEEDINGS OF THE COUNCIL IN APRIL

AT A MEETING of the Council on the 17th April, with Professor Sir James Paterson Ross, President, in the Chair, Mr. T. Keith Lyle was elected a Member of the Court of Examiners to examine in Ophthalmology for the Fellowship.

Dr. R. B. Kerr, Professor of Medicine, University of British Columbia, was appointed a Sir Arthur Sims Commonwealth Travelling Professor to visit Britain and parts of Africa in 1959. Professor E. J. Wayne, Regius Professor of the Practice of Medicine, University of Glasgow, was appointed a Sir Arthur Sims Commonwealth Travelling Professor to tour Canada in 1959.

It was agreed to establish a Chair of Anaesthesia in the College and the Council expressed their warmest thanks to the British Oxygen Company for a gift for this purpose.

The following Medical Practitioners of twenty years' standing were elected Fellows of the College without examination :

Professor R. W. Scarff.

Air Vice-Marshal J. C. Neely, C.B.E.

Mr. George Bell, O.B.E.

Mr. G. H. Thomas, O.B.E.

Professor F. C. Wilkinson, C.B.E.

Professor A. E. Galloway, M.B.E.

Mr. A. S. Prophet and Mr. R. J. S. Tickle were elected Fellows in Dental Surgery.

The Jacksonian Prize for 1957 was awarded to B. B. Milstein, F.R.C.S.

The Council selected the following subject for the Jacksonian Prize for 1959 : " Non-specific granulomata of the Alimentary Tract."

Mr. P. C. Williams and Dr. F. C. Chesterman were appointed Imperial Cancer Research Fund Lecturers for 1958.

Gifts for the restoration of Down House were received from Glaxo Charity Trust (£500) and Messrs. N. M. Rothschild & Sons (£250).

Diplomas of Fellowship were granted to P. M. Marnie (Sydney) and M. F. Sturridge (Middlesex).

Diplomas were granted, jointly with the Royal College of Physicians, as follows :

Ophthalmology (25); Laryngology and Otology (1); Physical Medicine (2); Tropical Medicine and Hygiene (27).

PROCEEDINGS OF THE COUNCIL IN APRIL

The following hospitals were recognised under paragraph 23 of the Fellowship Regulations :

HOSPITALS	POSTS RECOGNISED		
	General (all 6 mths.)	Casualty (all 6 mths.)	Unspecified (all 6 mths.)
WOLVERHAMPTON — New Cross Hospital	Surgical Regr. 2 H.O.'s		
WOLVERHAMPTON—Royal Hospital (Additional)	Surgical Regr.		
WARWICK — King Edward VII Memorial Chest Hospital			J.H.M.O. (S.H.O.) (Thoracic Surgery)
LONDON—Putney Hospital (Additional)	H.S.	<i>Temporary recognition continued until Jan. 1959</i> 2 Cas. Offs.	
HASTINGS Group of Hospitals (Revision)	R.S.O. at the R.E.S.H., St. Helen's and Bexhill Hosps. H.S. at R.E.S.H. H.S. at St. Helen's	2 S.H.O.'s (Cas. and Orth.) at the R.E.S.H.	H.S. (Surg. and Urology) at the R.E.S.H.

DIARY FOR MAY

Fri. 16	5.00	Board of Faculty of Dental Surgery.
Tues. 20	5.00	MR. C. R. McLAUGHLIN—The cleft palate.
	6.15	DR. L. FORMAN—Oral manifestations of skin diseases—I.
Thur. 22	5.00	MR. B. COHEN—Secondary tumours of the jaws.
	6.15	DR. L. FORMAN—Oral manifestations of skin diseases—II.
Sat. 24		College closed.
Mon. 26		WHIT MONDAY. College closed.
		Last day for nomination of candidates (L.D.S.) for election to the Board of Faculty of Dental Surgery.
Tues. 27	5.00	DR. J. C. HOUSTON—Blood diseases in relation to dentistry.
	6.15	MR. G. T. HANKEY—Disorders of the mandibular joint.
Wed. 28		Primary F.R.C.S. Examination begins.
Thur. 29	5.00	PROF. M. A. RUSHTON—Lesions of the lips.
	6.15	MR. A. M. A. MOORE—Soft tissue infections of the face and neck.

DIARY FOR JUNE

Mon. 2		Basic Sciences Lectures and Demonstrations for Dental Students begin.
Tues. 3	5.00	PROF. E. D. FARMER—Oral ulcers.
	6.15	MR. R. T. PAYNE—Diseases of the salivary glands.
Wed. 4		Primary F.F.A. Examination and Final L.D.S. Examination (Part I) begin.
Thur. 5	5.00	DR. A. EDRIDGE—General medication for the dental patient.
	6.15	MR. TERENCE WARD—Fractures of the facial bones.
Wed. 11	2.30	Diploma granting ceremony.
	7.30	Monthly Dinner.
Thur. 12		Final L.D.S. Examination (Part II) begins.
	2.00	Pre-Medical Examination and D.P.M. Examination (Part I) begin.
Mon. 16		Council.
Tues. 17		Anaesthetic course begins.
		Names of candidates (L.D.S.) for election to the Board of Faculty of Dental Surgery announced.
Thur. 19		First Membership Examination, D.L.O. Examination (Part I), D.P.M. Examination (Part II), and D.P.H. Examination begin.
Fri. 20		Election of Fellows to the Board of Faculty of Dental Surgery.
		Dental Lectures and Clinical conferences end.
Wed. 25	5.00	Board of Faculty of Anaesthetists.
Thur. 26		D.L.O. Examination (Part II) begins.
Fri. 27		Anaesthetic course ends.



6

OLD DISLOCATIONS OF THE ELBOW

Hunterian Lecture delivered at the Royal College of Surgeons of England

on

26th September 1957

by

J. Francis Silva, F.R.C.S., F.I.C.S.

Surgeon-in-Charge, Orthopaedic Department, General Hospital, Colombo, Consultant Orthopaedic Surgeon, Lady Ridgeway Children's Hospital, Colombo, and Lecturer in Orthopaedic Surgery, Faculty of Medicine, University of Ceylon

DISLOCATION OF THE elbow is a common lesion resulting from trauma to the upper extremity. Such patients who present themselves for treatment and are seen soon after sustaining the accident present no problems to the surgeon who is called upon to treat these cases.

When we are confronted with dislocations which are several months or years old, the position presents a problem of the highest magnitude as in these cases the arm is fixed in extension or in very slight flexion which is at the most only five degrees.

I am sure that this type of case is not seen in any of the Western countries and with well developed orthopaedic units this problem should be a thing of the past.

We who are called upon to practise in the Near and Far East, however, are still faced daily with this condition. The cases coming up for treatment vary from several weeks to years. That these cases do exist in eastern countries is the result of the existence of an ancient system of medicine which is several centuries old. This system was at its height during the reign of Alexander the Great, 300 B.C., in India from whence it came to Ceylon. It had been a system that has been practised by individuals who were supposed to teach the art of healing to the eldest male heir of the family who in turn would practise these methods. Hence for want of an organised system of teaching, this practice, called the indigenous or ayurvedic system of medicine, has slowly faded away in stages. In Ceylon it was at its height in the reign of King Dutugemunu 161 to 137 B.C., whose physicians treated soldiers of his army, who had fractures and dislocations, by these methods. Their methods consisted of manipulative reduction of fractures and dislocations followed by very simple splintage using mixed preparations of the barks of certain local trees incorporated in the splint. The barks of these trees are finely powdered, mixed with powdered coconut kernel, and spread around the injured limb in contact with the skin, incorporating the preparation in the splint (Fig. 1a). Some of the trees used for this purpose are *Crataeva roxburghii*, *Ficus glomerata*, *Morinda tinctoria* and *Morinda citrifolia*.

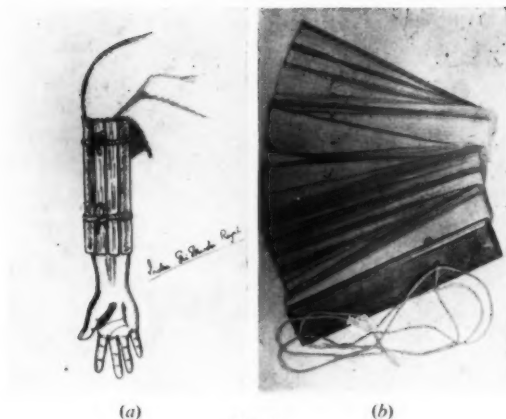


Fig. 1.

This period of application of barks mentioned above is sometimes followed by an application, generally of a paste made of the roots of certain trees like *Gmelina asiatica*, *Cassia auriculata* and *Azadirachta indica*, into which is incorporated among other things copper sulphate, alcohol and arecanuts. The paste is believed to cure any limitation of movements that should remain within a very short period, generally hours. These methods of treatment outlined have practically died with the ancient culture of our land and what exists today amounts to nothing but an organised form of quackery. For most of the indigenous practitioners of today who treat patients have not been taught as such, but have by some chance come across some of the ancient writings of the masters on

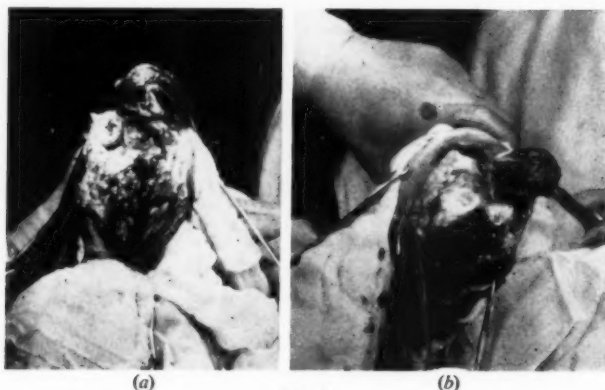


Fig. 2.

OLD DISLOCATIONS OF THE ELBOW

ola leaves (Fig. 1b) and picked up a smattering of a knowledge of the art that once was. Due to the ignorance and blind faith of most of the people in the villages, they first go to these physicians soon after injury and I have yet to see the patient whose dislocation or fracture has been set by anyone of them, yet the faith continues and we are confronted with a large problem.

PATHOLOGICAL CHANGES

The joints of these patients, who have been unfortunate enough to be treated by this practically dead system of medicine, I mean dead in the sense that it produces no results, present the Orthopaedic Department with a variety of pathological changes.

1. Exposure and examination of these joints have shown fairly extensive myositis ossificans around the joints. The muscles chiefly affected are the brachialis and the triceps brachii.

2. Extensive amounts of osteoid tissue are scattered around the olecranon, radius, ulna, coronoid and olecranon fossae of the humerus (Fig. 2a).

The presence of these two changes can be due to the extensive massage with the paste or to the irritant action of these medicinal herbs or both.

3. Marked shortening of both medial and lateral ligaments of the elbow joint is always present and becomes an obstacle to reduction, especially where there is medial or lateral displacement with the dislocation.

4. Ossification or fibrous thickening of the capsule of the elbow joint. Both these changes are shown in Fig. 2b.

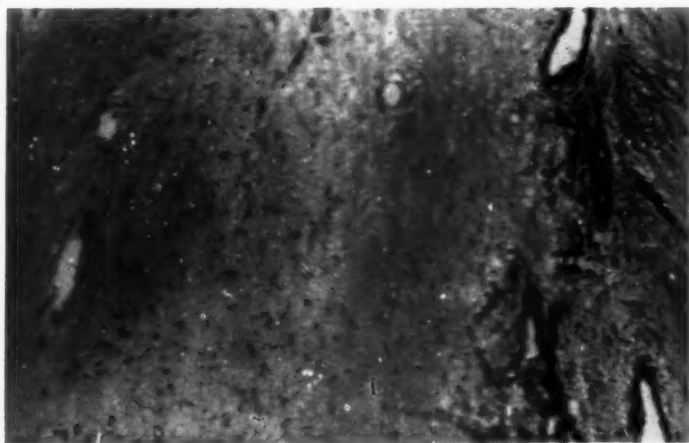


Fig. 3.

5. Destruction of the synovial membrane which is replaced to a large extent by extensive fibro-fatty tissue, Fig. 3 shows a microscopic slide depicting the histology of such tissue. Even after a few weeks there is complete disappearance of the synovial membrane.

6. Marked tightening of the ulnar nerve on any attempt at flexion of the elbow joint during its reduction. This is due to the nerve having been in extension for a period of several months or even years (Figs. 4a and 2b). This condition of the nerve warrants transposition to prevent ulnar neuritis which follows in every case where this is not done. Transposition of the ulnar nerve has been a routine procedure in this series.

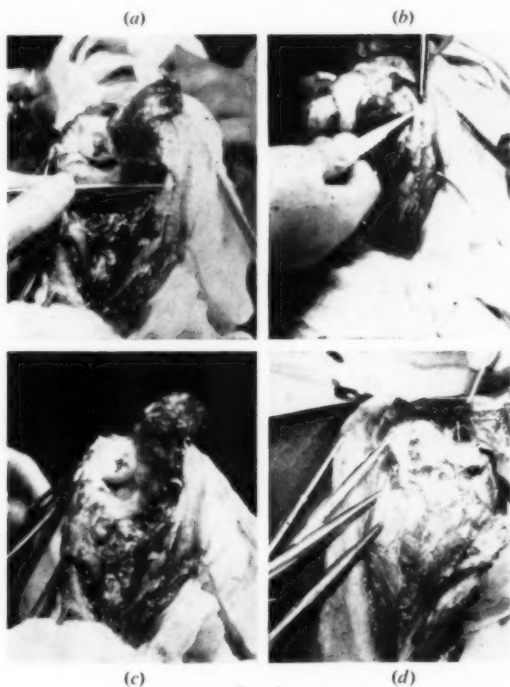


Fig. 4.

7. Cases that have come after very recent application of these remedies show a curious effect in that there is a tendency for the articular cartilage to peel off from the bone not unlike a banana skin (Fig. 4c). The entire articular cartilage could be removed from the humerus, ulna or radius in this manner. In old standing cases the articular cartilage is destroyed and at operation looks rather like an opening into an osteo-arthritic joint (Fig. 4d).

OLD DISLOCATIONS OF THE ELBOW

8. The triceps muscle is contracted, fibrosed to some slight extent and very much shortened. This makes a V to Y lengthening an absolute necessity.

RADIOLOGICAL CHANGES

1. There is a marked backward displacement of the proximal end of the ulna, which is often adherent to the posterior surface of the humerus (Fig. 5a).
2. There is loss of joint space. This loss is more extensive in the old standing cases and sometimes there is hardly any joint space at all (Fig. 5b).
3. Myositis ossificans is present in varying degrees around the joint.

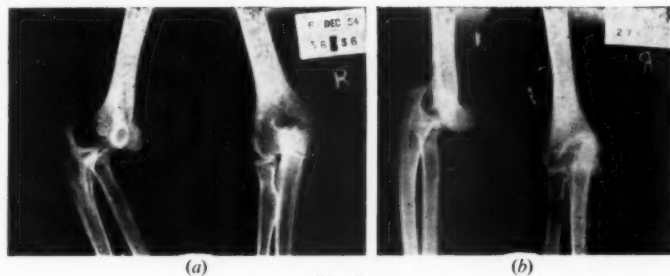


Fig. 5.

EVOLUTION OF TREATMENT

The treatment of these joints has throughout proved unsatisfactory and for lack of clinical material in other parts of the world the scope for research and investigation of the problem has been very limited.

We were thus compelled to follow the first obvious suggestion, namely that of open reduction, as closed reduction is impossible by the time these patients reach us. Something had to be done for these cases as they were mostly manual labourers on tea, rubber, coconut plantations or rice fields. It is needless for me to say that the results have not proved very encouraging nor was one able to predict the result with any accuracy. We were thus driven to investigate other possibilities and arthroplasty of the elbow joint, using fascia, was given a fair trial.

The evolution of arthroplasty goes back to Murphy who investigated the problem in July, 1904, and his experiments on dogs are indeed regarded as a milestone in the history of arthroplasty.

Buxton (1955) states that J. Rea-Barton of Philadelphia is credited as being the first to perform an arthroplasty in 1927. This he did in the hip joint. Since that time arthroplasty has been attempted for various joints.

In all this early work infection was indeed a large problem. This position is now a thing of the past especially with the development of modern surgical techniques and the use of antibiotics.

One thing however is that too wide an excision of bone in doing an arthroplasty is not advisable even though it helps the range of movement, for it leaves behind a swollen and painful forearm due to interference with lymphatic and venous drainage.

Gratz (1934) was one of the early pioneers of the use of fascia in surgery. He postulated that as transplanted living tissues rely for their nourishment solely on their lymphatic supply, the transplant should have adequate apposition to the bone against which it is placed. Areolar tissue should not intervene between them and above all trauma to the transplant should be avoided. Even with all these precautions the range of movement was never like what was desired.

Campbell (1929) attributed the lack of success in elbow joint injuries to be due to the complicated anatomy of the elbow and stated that the elbow consisted of two joints co-opted in one.

Having considered all these possibilities and the fact that open reduction afforded results which were not on the whole encouraging, we then embarked on an arthroplasty of the elbow joint using fascia lata to cover the reshaped articular surfaces of the lower end of the humerus, radius and ulna making sure that there is perfect apposition of the fascia lata to the bone. The amount of bone excised in these cases was always kept to a bare minimum. The results of these operations have been only very slightly more encouraging than simple reduction in that we were able to get less cases in Grade VI of our classification.

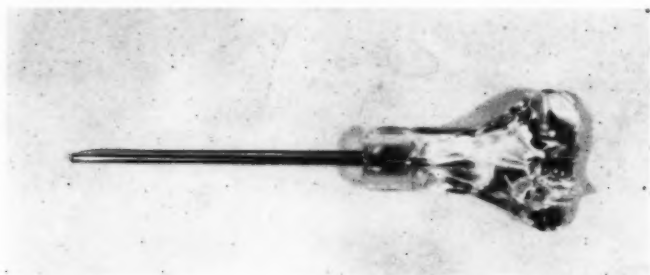


Fig. 6.

As the results of arthroplasty using fascia lata were by no means perfect we were forced to investigate the problem of an arthroplasty on similar lines to that done for the hip, first advocated by the brothers Judet of Paris. Excision of the lower end of the humerus which is the most extensively damaged component of the joint and its replacement by a prosthesis shaped to suit the case was thought to be a possibility (Fig. 6). The ulna could always be shaped to fit such a prosthesis. Further, as the question of weight bearing did not come into this, it was considered that

OLD DISLOCATIONS OF THE ELBOW

(a)

(b)



(c)



(d)

Fig. 7.

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complications like fractures of the prosthesis which are associated with the hips should be remote and this should be the answer to our problem. That this foreign substance—methyl polymethacrylate—which is an acrylic resin, produces no reaction is known, the other being vitallium (Nissen, 1954).

This resin came into the use of surgery after several years of research on the body's reactions to such substances introduced into it. Having thus conceived the idea, Messrs. Lusterlite of Leeds were requested to turn out the Lower Humeral Prosthesis in three sizes, large, medium and small. Of these sizes the medium and small are more commonly used due to the small stature of our race.

The approach to the joint adopted is that of speed (Campbell, 1956). This approach has the advantage in that it affords an opportunity to deal with three of the main difficulties in reduction, difficulties which if not satisfactorily surmounted would lead to poor function.

The difficulties are a marked shortening of the triceps tendon, the stretched ulnar nerve and shortened medial and lateral ligaments of the elbow joint. The skin incision is as shown in Fig. 7a. This is followed by reflexion of the skin, exposure of the triceps muscle and tendon (Fig. 7b). The triceps tendon is then detached from the triceps muscle (Fig. 7c), the belly of the muscle is split (Fig. 7d) and sub-periostally stripped off from the bone. By careful dissection the ulnar nerve is exposed, freed and transferred anteriorly (Fig. 8a). Dissection is then carried on around the joint removing the osteoid and fibro-fatty tissue around it, at the same time gradually flexing it (Fig. 8b).

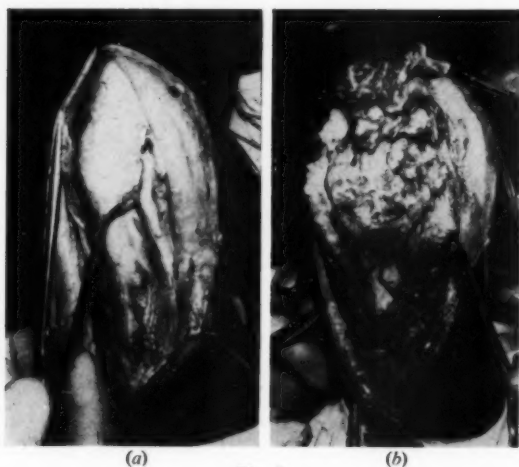


Fig. 8.

OLD DISLOCATIONS OF THE ELBOW

Finally the dislocation is reduced and the wound closed in layers in cases of simple reduction. In all cases where we used fascia lata, the surfaces of the three bones of the joints are excised, reshaped, covered with fascia lata and a similar closure adopted, while in those cases of acrylic arthroplasty the same incision is adopted, and the early stages of the exposure and operation are identical.

Having reached this stage the lower end of the humerus is dissected free (Fig. 9a) and is excised, the amount excised being determined by the size of the prosthesis (Fig. 9b). Too extensive an excision of the humerus produces instability of the elbow, allowing a degree of lateral and medial deviation of the forearm and hand on the humerus, while too limited an excision interferes with functional results in that the prosthesis fits too tightly to the reshaped ulna. Figures 10a and 10b show the fitting and

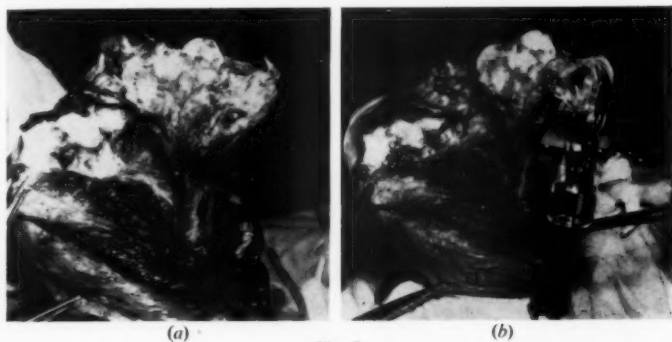


Fig. 9.

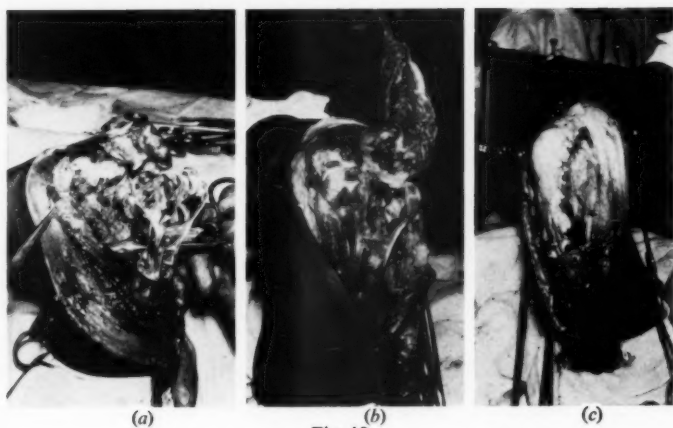


Fig. 10.

replacing of the radius and ulna in the prosthesis. The wound is closed in layers over the prosthesis, with V to Y lengthening of triceps (Fig. 10c). This lengthening was done in all cases in the series. Post-operatively the patients are put in above elbow plasters, the sutures are removed on the fourteenth day, and after the third week following removal of plaster, the patient is given intensive physiotherapy.

EVALUATION OF RESULTS

Forty-four cases have been treated in this series during the period 1952 to the present time in my unit of the Orthopaedic Department (Table I).

TABLE I
ANALYSIS OF OPERATIONS

	No. of cases	Percentage
Open reductions	25	56.82
Arthroplasty	11	25.00
Acrylic prosthesis	8	18.18
Total	44	

Open reductions have been done in twenty-five cases and form the largest group, being 56.82 per cent. of the series.

Arthroplasty using fascia lata comes second with eleven cases, forming 25 per cent. of the series.

The last eight cases have been fortunate to be given the most recent development for this condition.

This encouraging group of eight cases is only 18.18 per cent. of the series, as this method has been our latest advancement in the treatment.

ANALYSIS OF CASES OF OPEN REDUCTION

The results of all these cases have been placed in one of six grades, depending on the range of flexion—extension that they have been able to attain after surgery.

TABLE II
ANALYSIS OF CASES OF OPEN REDUCTION

	Grade I	Grade II	Grade III	Grade IV	Grade V	Grade VI
Range of movement ..	Over 145°	95°–140°	60°–90°	40°–55°	20°–35°	15° and less
No. of cases	1	1	5	9	7	2
Percentage relative to total number of cases of open reduction	4	4	20	36	28	6
Percentage relative to total number of cases ..	2.27	2.27	11.36	29.45	15.91	4.54

OLD DISLOCATIONS OF THE ELBOW

(a)

(b)



(c)

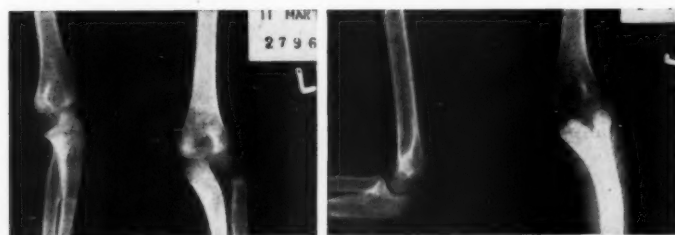
(d)

Fig. 11.

Table II shows the grading and the results of simple open reduction. It will be noted that only two cases had remarkably good results, there being only one case in Grade I, Case No. 9, and Figures 11*a, b, c* and *d* show the range of movement in this patient; and one in Grade II, Case No. 24, Figures 12*a* and *b* showing the pre- and post-operative X-rays, while

(a)

(b)



(c)

(d)

Fig. 12.

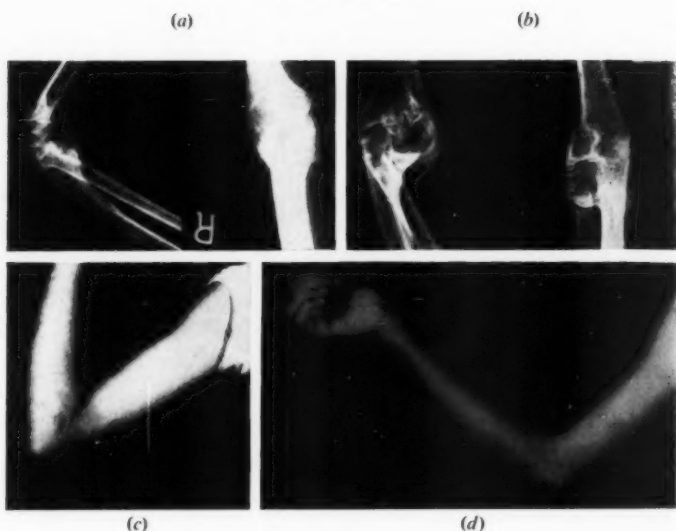


Fig. 13.

Figures 12c and d show the range of flexion—extension. This shows that after treating a fairly large series of twenty-five cases only 4 per cent. were able to have over 145° of movement and 4 per cent. had between 95° and 140° of movement. This result is indeed very unsatisfactory as it means that only 2.27 per cent. can hope to have any range of movement worthwhile.

Table II also shows that the largest group into which these cases can be placed fall into Grade IV and Grade V, which means that the majority of cases can only hope to have a range of 15° of movement. These two groups form 36 and 28 per cent. for this operation and 29.45 and 15.91 per cent. respectively for the whole series. Figures 13a and b show pre- and post-operative X-rays of Case No. 20 while Figures 13c and d flexion—extension in this patient.

The shortest time that has elapsed between the injury and coming for treatment in this group is four weeks while the longest is thirteen years. The average time between injury and surgery is 19.24 months.

Table III shows the distribution of cases so treated. Here the results have been only very slightly more encouraging than the simple open reduction in that most of the cases fall into Grade III or IV and the number of cases in Grade V is less than in the preceding series, there

OLD DISLOCATIONS OF THE ELBOW

TABLE III
ANALYSIS OF CASES OF ARTHROPLASTY USING FASCIA LATA

	Grade I	Grade II	Grade III	Grade IV	Grade V	Grade VI
Range of movement ..	Over 145°	95°-140°	60°-90°	40°-55°	20°-35°	15° and less
Number of cases	—	—	3	4	3	1
Percentage relative to total number of cases of arthroplasty with fascia lata	0.00	0.00	27.27	36.36	27.27	9.09
Percentage relative to total number of cases ..	0.00	0.00	6.82	9.09	6.82	2.27

being only 6.82 per cent. as compared to 15.91 per cent. of the preceding group.

Figures 14*a*, *b*, *c* and *d* show the range of movement of Case No. 15 and Figures 15*a* and *b* show the pre- and post-operative X-rays of the same case.

In this series the shortest duration between the accident and coming for treatment is three weeks, while the longest is eighteen months, giving an

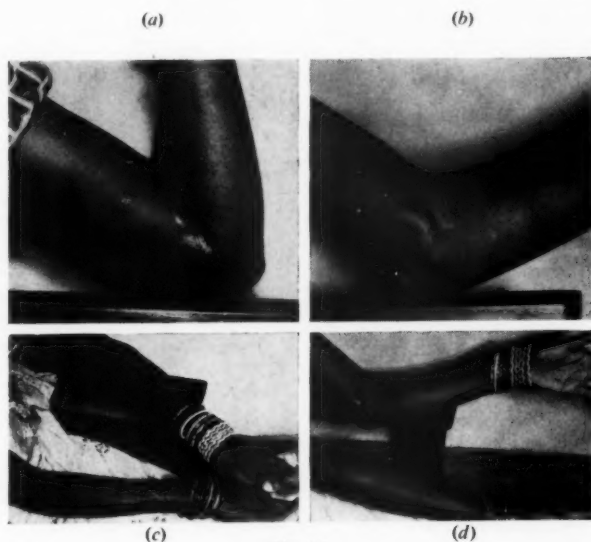


Fig. 14.

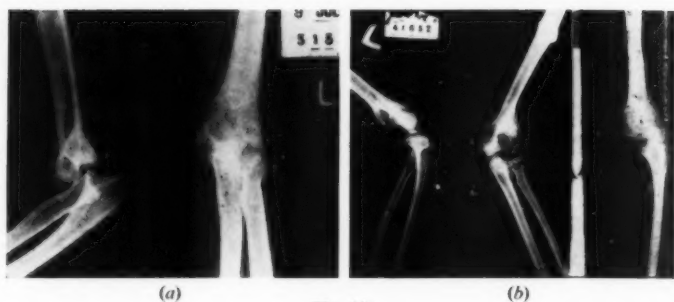


Fig. 15.

average of 5.34 months. When one considers the shortest time factor of this series, the slight encouragement on seeing the figures in Table III gives rise to despair and it is thus evident that arthroplasty with fascia lata is not the answer to our problem.

TABLE IV
ANALYSIS OF CASES OF ACRYLIC ARTHROPLASTY

	Grade I	Grade II	Grade III	Grade IV	Grade V	Grade VI
Range of movement ..	Over 145°	95°-140°	60°-90°	40°-55°	20°-35°	15° and less
Number of cases	—	3	2	2	1	—
Percentage relative to total number of cases of acrylic arthroplasty ..	0.00	37.5	25.0	25.0	12.5	—
Percentage relative to total number of cases ..	0.00	6.82	4.5	4.5	2.27	—

Table IV shows that the few cases in this Group have indeed given us very encouraging results. Figures 16*a, b, c* and *d* show a range of movement of Case No. 37, the range being 130° of flexion and full extension with 100 per cent. supination and 80 per cent. pronation. Figures 17*a, b, c* and *d* illustrate the range of movement of Case No. 38. Figures 18*a, b, c* and *d* depict the range of movement of Case No. 39, who had a range of movement of 65° five weeks after operation, while eight weeks after operation Case No. 37 showed a range of movement of 130°.

In this group the earliest case was of three months duration while the longest is fifteen years, giving an average time period of 28.25 months between the injury and operation. In spite of this long time lag there are three of our eight cases in Grade II, with two in Grade III and IV respectively, giving a percentage of 37.5 in Grade II and 25 per cent. each for the other two Grades for this series.

OLD DISLOCATIONS OF THE ELBOW

(a)

(b)



(c)



(d)

Fig. 16.

(a)

(b)



(c)



(d)

Fig. 17.



Fig. 18.

PRONATION AND SUPINATION

It has been rather difficult to fit in the results of this movement into our grading of cases. Tables V(a) and V(b) show the ranges of this movement for all our cases.

Four cases of this series have had no pronation or supination, the forearm being fixed in mid-position.

All other cases have had varying ranges of pronation from 50 per cent. to full. The majority have been at 50 per cent. Full pronation has been present in four cases while the others have varied from fifty to ninety.

Supination seems to have been an easier movement to get back after operation. The lowest range again is 50 per cent. with only five cases in this group. Full supination has been obtained in twelve cases while in the majority it has varied between 75 per cent., 80 per cent. and 90 per cent.

In the series where acrylic lower humeral arthroplasty was done only one case has had the forearm fixed in mid-position and this is in the first case of our series. All other cases have had a reasonable range of movements.

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TABLE VA
OLD DISLOCATIONS OF THE ELBOW

Case No.	Duration	Operation			Pronation	Supination	Flexion	Extension	Range	Grade					
		+ Open Reduction	O Arthroplasty	Acrylic Prosthesis						I	II	III	IV	V	VI
1	2 months	*			% 90	% 100	% 70	% 120	% 50	145° and over	95°-140°	60°-90°	40°-55°	20°-35°	15° and less
2	2 months	*			100	90	90	135	45				+		
3	2 months		*		50	85	70	125	55				O		
4	9 months		*		Fixed in mid position		70	90	20					O	
5	6 months		*		50	70	70	130	60			O			
6	1 month	*			50	70	70	120	50				+		
7	6 months	*			50	50	50	70	20					+	
8	6 months	*			Fixed in mid position		50	80	30					+	
9	6 months	*			100	100	30	175	145	+					
10	2 months		*		50	85	80	120	40				O		
11	3 months	*			100	90	80	100	20					+	
12	1 year	*			75	95	70	110	40				+		
13	Over 3 weeks		*		75	75	110	155	45				O		
14	6 months	*			75	75	60	120	60			+			
15	8 months		*		Fixed in mid position		50	160	70			O			
16	8 years	*			50	50	100	160	60			+			
17	1½ years		*		75	75	60	90	30					O	
18	1 month		*		100	90	50	100	50				O		
19	1 month	*			75	75	100	150	50				+		
20	13 years	*			50	75	70	110	40				+		
21	2½ years	*			50	90	40	130	90			+			
22	10 years	*			90	80	85	95	10						+

TABLE Vb

Case No.	Duration	OPERATION		Pronation	Supination	Flexion	Extension	Range	GRADES					
		+ Open Reduction	O Arthroplasty						I	II	III	IV	V	VI
				% 75	% 100	% 85	% 110	% 25	145° and over	95°-140° over	60°-90°	40°-55°	20°-35°	15° and less
23	4 months	*											+	
24	1 month	*		70	100	25	150	125		+				
25	3 months	*		75	100	95	130	35					+	
26	1 month	*		75	75	40	90	50				+		
27	2 years	*		70	100	60	75	15						+
28	2 months	*		50	90	90	125	35					+	
29	6 months	*		50	75	85	110	25					+	
30	9 months		*	50	75	80	90	10						O
31	4 months	*		90	60	70	120	50				+		
32	6 months	*		70	100	60	110	50				+		
33	4 months	*		50	75	40	100	60			+			
34	1 month	*		80	100	50	115	65			+			
35	1 month		*	90	100	50	120	70			O		O	
36	2 months		*	50	75	80	100	20						
37	1 year			80	100	50	180	130		-				
38	Over 15 years		*	Nil	Nil	75	135	60						
39	3 months		*	50	50	50	115	65						
40	3 months		*	Fixed in mid position		45	90	25						
41	5 months		*	50	100	45	155	+110					-	
42	7 months		*	75	100	35	145	+110		-				
43	1 year		*	50	50	60	110	50						
44	4 months		*	75	75	70	120	50						
	TOTAL	25	11					TOTAL	1	4	10	15	11	3

OLD DISLOCATIONS OF THE ELBOW

CONCLUSION

A fairly large series of cases for a condition that in reality should be extinct has been done. This is a condition that exists in Ceylon and will continue to exist for so long as this ancient system of medicine is practised and our people have faith in it.

From the evaluation of the results it seems evident that arthroplasty using acrylic prosthesis is the best possible choice at our disposal. As the question of weight transmission does not arise here, there should be no reason why this operation should have the usual complications that attend acrylic arthroplasty of the hip. The follow-up period is indeed short to vouch for this, but it is hoped that we will be able to do a much larger series of these cases in the not too distant future and to evaluate the results, which I feel confident could be very encouraging.

* In conclusion I must express my thanks to the entire staff of the Orthopaedic Department of the General Hospital, Colombo, and in particular to my House Surgeon, Dr. D. D. Samarasinghe, my Secretary, Mr. D. A. Herat, and Mr. G. Webster, who has been responsible for the clinical photography, and without whose co-operation this paper would not have been possible.

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THE RT. HON. LORD WEBB-JOHNSON OF STOKE-ON-TRENT

G.C.V.O., C.B.E., D.S.O., T.D., F.R.C.S.

Hon.F.A.C.S., Hon.F.R.A.C.S., Hon.F.R.C.S.(Edin.), Hon.F.R.C.S.(Can.),
Hon.F.R.C.S.(Ireland), Hon.F.R.F.P.S.(Glas), Hon.LL.D.

It is WITH regret that we have to report, at the time of going to press, the death of Lord Webb-Johnson on the 28th May 1958. Lord Webb-Johnson was the President of the College from 1941 to 1949. An appreciation of his life and work will appear in the July issue of the ANNALS.

MOLLUSCUM SEBACEUM AND ITS SURGICAL SIGNIFICANCE

(Synonyms : Keratoacanthoma, molluscum pseudocarcinosum.)

Hunterian Lecture delivered in the Royal College of Surgeons of England
on

21st November 1957

by

Sydney Thomson, F.R.S.Ed., M.A., M.D., F.R.C.P.

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INTRODUCTION

ALTHOUGH THESE TUMOURS were in fact first described by Dupont in 1930 under the title "kyste sébacé atypique," we in this country remained ignorant of the condition until MacCormac and Scarff published their article in 1936, giving the name "Molluscum Sebaceum." They had seen about ten cases over a period of ten years. This paper created some discussion at the time but its importance was not then fully realized. During that year there were certain political distractions which involved Italy, as well as an International Congress of Dermatology in Budapest, the full programme of which had of course been arranged much earlier. From 1939 until 1946 we were all fully occupied, so it was not until the next few years that attention was again drawn to the condition. In 1950 Rook and Whimster published the St. Thomas's Hospital findings in the Belgian Archives. During the same year Musso showed a case for Hugh Gordon at the Royal Society of Medicine and it is from that point that our appreciation of the lesions really dates. Since then many publications have stressed its importance, publications in Australia, Belgium, France, Holland, New Zealand and the United States of America. Full recognition has been achieved everywhere in dermatological circles during the last four years, but experience does show that clinical recognition is still very largely restricted to those same circles.

The name *Molluscum Sebaceum* has been retained for the purposes of this lecture chiefly as a tribute to the late Dr. MacCormac. In fact, however, many dermatologists prefer the title "Keratoacanthoma," first suggested by Freudenthal. Certainly this alternative does lessen the possibilities of confusion with the other mollusca.

Clinical picture

MacCormac's original description still holds good. "The nodule was hemispherical, the size of a small nut, clothed with normal skin except on the upper surface, upon which there was a thin, slightly depressed, adherent scale. When the scale was peeled off, which could only be done with difficulty, breaking away in fragments during the operation, a rough, irregular, almost papilliform under-surface was exposed to view. The nodule was firm to the touch and almost painless."

MOLLUSCUM SEBACEUM AND ITS SURGICAL SIGNIFICANCE

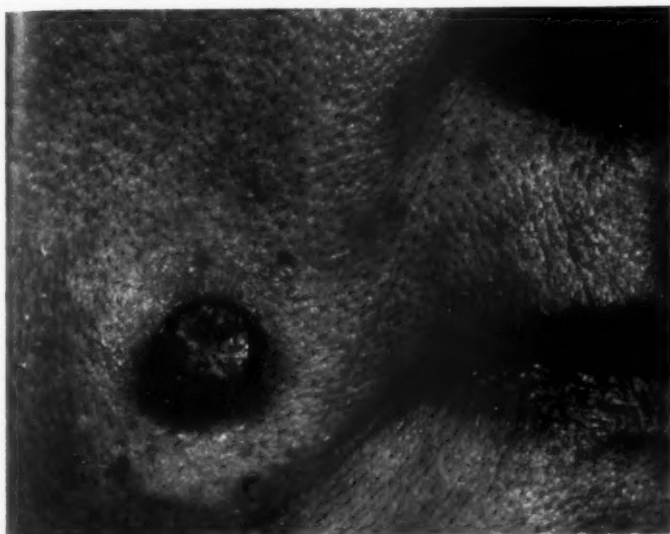


Fig. 1. Lesion of four weeks' duration in a woman aged forty-six. Excised and confirmed histologically.



Fig. 2.

Fig. 2a. Lesion presented five weeks after onset, in a man aged 39, F.S. Allowed to heal spontaneously.

Fig. 2b. Same lesion in F.S. six weeks later, i.e., eleven weeks after onset.

Fig. 2c. Same lesion in F.S. two weeks later, i.e., thirteen weeks after onset.

The scale is in fact the keratotic plug which is always firmly embedded and which can only be removed with some force to leave a bleeding rather granular surface. Gordon was the first to stress its importance in the diagnosis. The rest of the tumour has a smooth shining convex surface, bowed outwards so that the body sits on the skin rather like a gourd.



Fig. 3. Lesion in a woman aged 86. Excised and confirmed histologically.
Note unusual horn formation.

The curved side shows no translucency but sometimes has telangiectases running up from the normal skin and it is this feature which has led to the usual misdiagnosis of rodent ulcer. Occasionally the tumour flattens as it grows so that it then looks very like the underside of a small gladiolus bulb.

MOLLUSCUM SEBACEUM AND ITS SURGICAL SIGNIFICANCE

Resolution largely occurs by resorption but the larger specimens develop a black central eschar which separates to leave a superficial ulcer with a soft outer shell. This edge remains for a short time as a surrounding wall or may show partial collapse to give an appearance of undermining. At whatever stage the growth resolves, and it can disappear at any stage, it always leaves proportionate scarring. This gradually becomes much less obvious with the passage of time.

In three patients I have seen the keratotic plug grow into a horny excrescence, once being quite indistinguishable from an ordinary cutaneous horn except for the underlying cushion of growth. In the other two cases it grew into a spike.

Size and duration

Whilst the clinical features are now sufficiently appreciated to allow a firm diagnosis in most cases, there are other helpful points. The first is to be found in the life-history of the tumour. It is the rapidity of the growth which is so striking. Very occasionally the patient may describe an antecedent comedone, or a small boil, or slight local damage, but when the nodule becomes evident it rises quickly above skin level. Advice is then sought within six to eight weeks by which time the lesion is usually about one centimetre in diameter. The largest has been seen by Sommerville and this had a diameter of four centimetres. In those cases which have been allowed to resolve spontaneously, complete disappearance can be said to be the rule within four to five months. There seems no doubt that all would disappear spontaneously were they allowed to do so. Very, very rarely there have been cases of twelve months' duration, cases confirmed histologically. It is this speed of growth and natural history of the lesion which form the second diagnostic point.

TABLE I
MOLLUSCUM SEBACEUM

Source	Average Duration of all Cases before Consultation	Lesions left to heal spontaneously	Total Average Life of the Lesions left to heal
	Weeks		Weeks
BEARE	7	5	16
BOLAM	7½	4	—
MACKENNA	—	7	—
PETERKIN	8½	4	12
ROOK	—	2	—
ROOK AND WHIMSTER	5½	2	22
SOMMERVILLE	7½	15	20
THOMSON	8	4	18
VICKERS	9	5	12
	7½	48	17

Site

The vast majority of the tumours affect the face and are then usually seen on the central vertical third. Some (11.8 per cent.) are seen on the ears or neck, but only about 12.5 per cent. have been found on the forearms, hands, thighs, chest, shoulder and scalp.

TABLE II
MOLLUSCUM SEBACEUM SITES

Source	Face	Ears	Neck & Mastoid	Else-where	Remarks
BEARE	65	4	5	2	Both Forearms.
BOLAM	32	—	3	6	1 Forearm, 1 Leg, 4 Hands.
MACKENNA ..	13	—	—	—	—
PETERKIN ..	54	1	5	5	1 Forearm, 1 Wrist, 1 Chest, 2 Hands. 1 Patient had lesions, 1 Nose + 1 Cheek. 1 Patient had lesions, 1 Neck + 1 Cheek. Not noted separately.
ROOK	—	—	—	—	9 Hands, 2 Forearms, 1 Wrist.
ROOK & WHIMSTER	17	—	—	12	1 Hand, 2 Site unnoted.
SOMMERVILLE ..	21	1	2	1	1 Hand, 1 Chest.
THOMSON	29	3	2	2	—
VICKERS	34	2	3	5	1 Shoulder, 1 Chest, 1 Thigh, 1 Forearm, 1 Scalp.
	265	11	20	33	

Recurrences

Peterkin reports one case in his series, a man aged seventy-eight; the lesion was curetted twice, each occasion being followed by a recurrence. Final disappearance occurred after radiotherapy. Beare has reported five examples in a later paper which mentions a total of 122 cases seen by him. One rapidly followed the simple planing off of a lesion, but the second occurred on the hand of an elderly woman whose first growth disappeared spontaneously; the relapse developed a month later at the edge of the scar. Gordon has had one edge recurrence following simple shaving off and light cauterization of the base. Although not included in this series, mention must be made of one remarkable case seen by Rabut and Hewitt, a woman who had successive single lesions over a period of eighteen years. All affected the central area of the face.

Work

Among all these cases there have been but three tar or pitch workers. Reference is made later to the special problem of tar molluscum. In these 395 cases no significant facts could be found in the matter of past or present work contacts.

MOLLUSCUM SEBACEUM AND ITS SURGICAL SIGNIFICANCE

TABLE III
MOLLUSCUM SEBACEUM

Source	Simple Recurrence	Malignant Recurrence	Also showing Biotripsis	Possibly relevant Work
BEARE	5	—	4	1 Tar
BOLAM	—	—	—	0
MACKENNA	—	—	0	0
PETERKIN	1	2	0	1 Pitch
ROOK	—	2	—	0
ROOK & WHIMSTER	—	—	—	1 Gas Worker
SOMMERVILLE	—	—	0	1 Tar
THOMSON	—	—	1	0
VICKERS	—	—	0	0
	6	4	5	4

Exposure to light

In the whole series only five cases are recorded as showing any definite biotriptic changes. Considering the age incidence this figure is low and must have some negative significance when we come to discuss possible causative factors.

Clinical anomalies

Very few cases indeed have been seen which bore more than one lesion. Three have been noted among these 395, each having two growths. Peterkin reports a boy of nineteen years of age whose face bore five molluscum sebaceum tumours, four of them being clinically atypical. He also had two cases which later developed into squamous-celled carcinomata, the original diagnoses having been definite, both clinically and histologically. These are of great importance, being the first definite examples to demonstrate that the lesions can become truly malignant.

TABLE IV
MOLLUSCUM SEBACEUM

Source	Males	Females
BEARE	41	35
BOLAM	28	13
MACKENNA	6	7
PETERKIN	35	23
ROOK	41	30
ROOK AND WHIMSTER	19	10
SOMMERVILLE	16	11
THOMSON	16	20
VICKERS	26	18
	228	167

Sex incidence

There is a slight preponderance of men, but the difference is too slight to have any real significance.

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TABLE V
MOLLUSCUM SEBACEUM—AGE GROUPING

Source	0-49 Years	50-59 Years	60 Years and over	Total	Youngest Patient (Years)
BEARE	28	16	32	76	23
BOLAM	17	12	12	41	29
MACKENNA	2	5	6	13	42
PETERKIN	18	8	32	58	19
ROOK	21	20	30	71	?
ROOK & WHIMSTER	12	9	8	29	20
SOMMERVILLE	12	4	11	27	27
THOMSON	10	10	16	36	2
VICKERS	15	11	18	44	15
	135	95	165	395	

The condition is thus about twice as common after the age of fifty years.

Age incidence

Whilst cases have been reported between the ages of fifteen and eighty-three, there is no doubt that the highest incidence is in the age group "over sixty." Lapière has seen one example in a child only sixteen months of age, the lesion being on the cheek just below the right eye. This allows mention of the following case. A small girl, aged twenty-four months, attended King's College Hospital. She showed a growth, clinically classical, in exactly the same site, i.e., just below the right eye. It was then of six weeks' duration. Because of her age, the site and size of the tumour, and some confidence in the diagnosis, no treatment at all was



Fig. 4. Lesion in child aged twenty-nine months.

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given. Complete resolution occurred during the next eight weeks, to leave a small oval depressed scar. Since then there have been no signs of relapse and the scar is becoming less obvious.

Seasonal incidence

This analysis has been possible only in 136 cases. The prepared table shows no significant differences although there is just a suggestion that the incidence is lower during the summer months.

TABLE VI
SEASONAL INCIDENCE
Stories analysed to give month of onset

Source	January and February	March and April	May and June	July and August	September and October	November and December
PETERKIN ..	9	10	4	11	14	10
THOMSON ..	8	6	8	3	7	4
VICKERS ..	6	14	5	2	4	11
	23	30	17	16	25	25

Both Bolam and Rook state that there is no evidence of particular seasonal incidence among their cases.

Antecedent lesions

These are recorded for the sake of completion. It is extremely doubtful whether any significance at all can be attached to their occurrence. This is partly because the layman always looks for a cause and in so doing often inadvertently twists the evidence, and partly because such possible factors are noted in only fifteen of the 256 cases who were questioned on this point. "Insect bite," "injury," "burn" and "blind boil" are four vague descriptions. Two patients spoke of boils, five of blackheads, one of a stone splinter, two of warts and in one patient arsenical keratoses were present elsewhere.

Incidence relative to rodent ulcers and squamous-celled carcinomata

Before considering the various pathological aspects of the condition, it would be as well to estimate the relative incidence of the tumour, the real reason why this subject has been chosen. Taking only those figures which are absolute it is seen that 292 cases compare with 623 cases of squamous-celled carcinoma and 2,366 cases of rodent ulcer seen in the same clinics over the same periods of time. In percentages these figures represent 9, 19 and 72. Sufficiently close to these figures are estimates recorded by others in personal communications. Thus Beare believes that squamous-celled carcinoma is twice as common and that rodent ulcers are eight times

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as common. Gordon feels that there is little difference between the figures for molluscum sebaceum and for squamous-celled carcinoma. It is of course admitted that these figures vary somewhat in different clinics and for that variation there are many possible explanations; but taking an overall picture it is reasonable to say that about one in eleven of all growths in these groups is a case of molluscum sebaceum.

Because complete analysis of the figures has been impossible, this review has not included about 100 cases of molluscum sebaceum and tar mollusca seen at the Royal Marsden, nor has it included Belisario's results. He records 740 basal-celled growths during the same period that 175 squamous-celled growths were seen. He believes that about one-half of these latter were in fact keratoacanthomata.

Whilst discussing the question of incidence, some impressions should be mentioned. They are only impressions and cannot now be substantiated. MacCormac mentioned about ten cases over ten years. During that same period there were seen certain tumours which were then called the "button carcinomata of Savatard." It is probable that many of these were in fact mollusca. Yet there is still the fact that between 1936 and 1939 there were no reports of these growths in this country, whilst increasing numbers were seen over the post-war years. The features are so striking that it does not seem at all likely that they were completely unrecognized and were in fact then present in comparable numbers before 1946 and 1947. Gordon believes that the incidence is now showing a decline.

TABLE VII
COMPARATIVE INCIDENCE

Source	Rodent Ulcer	Squamous- celled Carcinoma	Mollus- cum Sebaceum	Confirmed Histo- logically	Remarks
BOLAM ..	779	218	41	—	These figures are exact for each period reviewed, some over two, and some over three years. They are strictly comparable.
MACKENNA ..	43	9	13	10	
PETERKIN ..	503	189	60	58	
ROOK ..	334	93	71	—	
SOMMERVILLE ..	225	53	27	8	
THOMSON ..	296	34	36	29	
VICKERS ..	186	27	44	20	
	2,366	623	292		
	72%	19%	9%		Percentage approx.
The following figures were given to me as approximations (for various reasons exact figures were not available):					
BEARE ..	76 × 8	76 × 2	76	74	{ Saw an additional 56 Tar Mollusca over the same period.
GORDON ..	—	93	44	—	
				199	

Histology

MacCormac and Scarff described the lesion as a raised cyst lined by hypertrophic squamous epithelium and communicating with the surface by an opening. The lining also showed some actual hyperkeratosis. Although there was no heavy infiltration by inflammatory cells, they regarded the growth as being caused by hypertrophic and inflammatory changes in a sebaceous cyst.

The description found in Calnan and Haber's contribution is among the best. It is now quoted at some length: "The lesion of molluscum sebaceum starts with hyperplasia of a group of follicles and this leads to hyperkeratosis and acanthosis with irregular down-growths to the sweat-gland level. The hyperkeratotic masses of the follicles merge into one central mass to form a crater, whereas the acanthotic areas merge to constitute an irregular invasion of the cutis. In some places the hyperplasia reaches such proportions that it is impossible to distinguish the individual follicles and there appears a compact irregular mass consisting of merged follicles and apparently also of down-growing rete pegs. . . . The corium itself provides the stroma, and hypertrophies by digitation of its papillae, leading to a keratoacanthotic 'papilloma,' but the lesion does not grow indefinitely, and as soon as it has, for some reason or another, spent its energy it comes to a halt and is destroyed by the ensuing inflammatory reaction. This is clearly shown by the round-celled infiltration invading the tumour and by the many micro-abscesses. Since, in this process, the papillary body is destroyed, the lesion heals with scarring."



Fig. 5. Whole section $\times 5\frac{1}{2}$. Shows very early changes in large number of adjacent follicles. From back of hand of a woman aged sixty-two. Lesion had been present for one month.

Further experience has thus led us away from the first simple conception of a sebaceous cyst change, although it has only substituted simultaneous changes in a group of follicles. The complicated histology is largely accounted for by the speed of the growth changes. Beare points out that the basement membrane is often missing in places, possibly because the rapidity of growth of the tumour and the inflammatory changes are relatively gross, so that the lining membrane cannot keep pace with its swelling contents.

It is understandable that errors in the interpretation of such a picture could easily be made and there seems no doubt that the varying planes of incomplete biopsies have led to the frequent diagnosis of squamous-celled carcinoma in these cases. For this reason it is important to excise the whole lesion and that to a sufficient depth in order to allow the true histological picture to be examined. Failing that ideal half the "cake" should be removed rather than a slice.

The differentiation from squamous-celled carcinoma is summed up by Whittle who notes that the cells show some irregular mitoses "but they are not anaplastic and the growing epithelial cords do not transgress the dermal boundary." In a letter Rook says, "the histological diagnosis of keratoacanthoma can be made with confidence in the absence of any history if the earliest changes of spontaneous involution are detectable. In the absence of such changes a confident diagnosis is often impossible unless the history of the lesion is available. The absence of mitoses and other histological indications of malignancy in a lesion which has been present for only three or four weeks is compatible with a diagnosis of keratoacanthoma. If such changes are seen in a lesion which has been present for three months they must be regarded with grave suspicion."

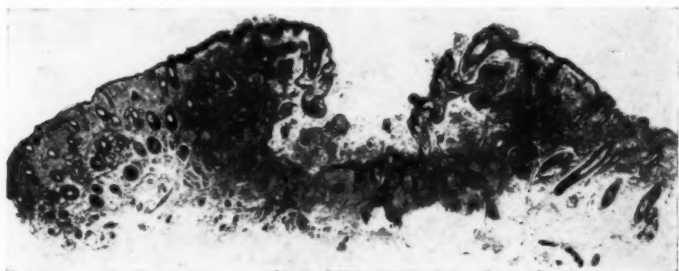
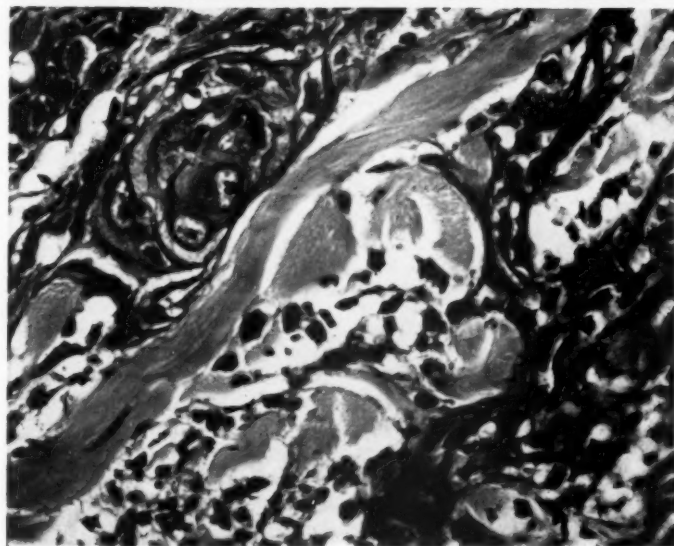
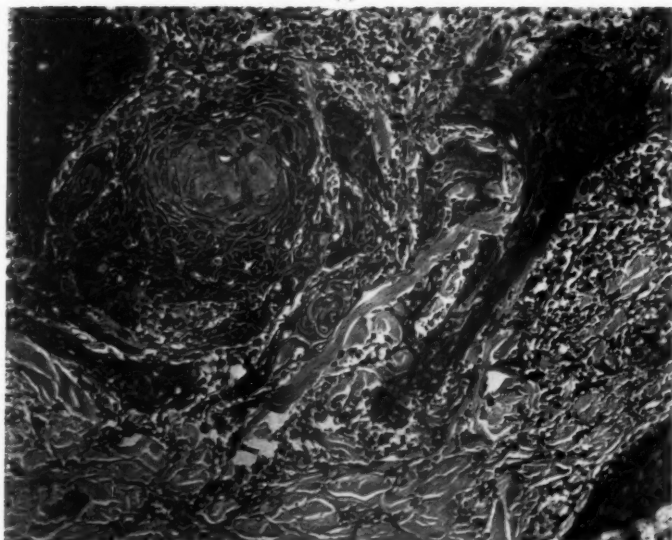


Fig. 6. Whole section $\times 5$. Shows collapse of surrounding wall so that the resulting ulcer tends to look rather like a rodent. From the chin of a man aged seventy-two. Lesion had been present for six weeks.

These descriptions and opinions have all emanated from dermatologists, but they do agree with the views of pathologists who are now generally aware of this condition. So a quotation from Magnus can conclude this

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(a)



(b)

Fig. 7a. Section stained by haematoxylin and eosin. $\times 120$. From the woman aged forty-six with the cheek lesion of four weeks' duration.

Fig. 7b. Centre of same section $\times 450$.

section. "The histological picture is striking but varies with the age of the lesion. When fully developed there is a crater which contains a varying amount of keratin and blood and this is surrounded by hyperplastic stratified squamous epithelium which may be of some thickness. The cells in the proliferating epithelium, however, have an orderly arrangement with no abnormal nuclear forms and mitotic figures are sparse. There is infiltration and considerable proliferation of chronic inflammatory cells outside the epithelium, which may cause distortion of it, particularly at the base. The epidermis on either side of the nodule sweeps up to the top of the crater and is remarkably normal in appearance. In such a section there is clearly no infiltration but, if it has been taken at a tangent, the histological picture may look very different and closely simulate a well differentiated squamous-cell carcinoma. This may also be the case if the nodule is sectioned at an early stage before the crater is fully developed."

Reference may perhaps now be made to the telangiectases so often seen running over the spreading edges of many cutaneous growths. As a mass of hyperplastic cells increases and spreads laterally, so is the epithelium stretched over the shoulders of such a mass. So, too, are the papillae with their capillaries. This stretching and pressure lead to partial obstruction and varicosity of these vessels so that they are seen coursing over the spreading edge of the growth. The picture is thus seen in this disease at times, molluscum contagiosum, squamous-celled carcinoma as well as in rodent ulcers. It is admitted that the relative greater hardness of the basal-cell mass will create greater pressure, so that the telangiectasis will be more marked in basal-celled growths, but it is only a matter of degree.

Experimental work

Oliver has attempted to provide evidence of a virus origin by the inoculation of his own skin with filtrates from fresh lesions. No positive results were obtained even with a variety of methods of attempted inoculation. May I quote his letter to me: "I should perhaps add that a criticism of my work is possible on the basis that I did not employ the commonest site for the lesion, namely the face, preferring to work upon my forearm." The forearm was also used by Beare in similar experiments on himself and a volunteer. He, too, was unsuccessful. Marshall and Findlay were unable to grow any virus on developing hens' eggs. Their investigations for fungi were also negative. The varied findings of Peyton Rous are most relevant. The carcinoids produced by tarring were histologically true carcinomata but they vanished when tarring ceased. Many became "warts" as proliferating connective tissue walled off the growths. Sometimes deeper epithelium was rounded up into cysts filled with keratinized material. They differ from true carcinomas in that they cannot proliferate independently as such and also have reversible malignancy of their cells and can undergo reversion into benign growths. Squamous-celled carcinomata may regress but they never undergo conversion into

benign growths. He found, too, that the vigour of virus papillomata generally exceeds that caused by tar and these growths become malignant more often. Anything which stimulates proliferation of the cells of the stratum germinativum automatically gives rise to papillomatous growths if the proliferation is superficial. Shope virus papillomata can become carcinoids and similar invasive downgrowth with anaplasia occurs after intradermal injection of Scharlach R or Sudan III in olive oil. He concludes that the frequency with which cancer develops out of virus growths varies with how hard the cells are driven by the virus. The more rapid the proliferation and the more the cells are played on by extraneous stimuli (incision, bacterial infection, chemicals) the sooner and oftener does malignancy occur.

In the group of the tar mollusca and tar carcinomata we seem to have comparable features. Peterkin's two examples of keratoacanthomata which later became frank squamous-celled carcinomata offer a useful parallel observation.

Reference must also be made to Whiteley's experiments on rabbits. He used the Shope papilloma virus because of its power of stimulating epidermal proliferation to a high degree. When inoculation occurred during the period of active hair growth stimulated by plucking, larger and more numerous tumours always developed. The virus may be more localised in the actively growing tissues, i.e., the damage caused by the virus is closely related to the metabolic activity of the tissue. The tumours so produced are also at first invasive and do later undergo regression.

More recently he has found that the local use of an anthracene caused the development of a lesion very like molluscum sebaceum, but this occurred during the resting phase when the germinal bud was superficial. This tar derivate caused no such growth when used during the active phase of the hair-growth cycle. He also noted that these lesions were produced where the hair was of finer texture, a feature which might help to explain the distribution of keratoacanthomata.

Finally, Ereaux has recently claimed to have grown a virus from a case with multiple lesions. This is said to have some resemblance to the virus of molluscum contagiosum but to be clearly different therefrom.

Cause and nature

Unfortunately we cannot yet claim to have found a definite cause. Oliver believes that chemical irritation is the detonating factor. Some support is lent to this idea by Gordon's experience with tar mollusca. Special attention must be paid to his views in this matter, for his experience with these growths at the Royal Marsden is probably far greater than has been the lot of anyone else in this country. Whilst many of these tar lesions remain small and often rub off spontaneously, most form a small base and then tend to increase in size very slowly. A certain number, however, suddenly take on a rapid growth, for no discovered reason. The

members of this last group are absolutely indistinguishable from keratoacanthomata both clinically and histologically. Gordon has been able to watch some of these disappear spontaneously, thus imitating molluscum sebaceum completely. When the tar lesions do become frankly carcinomatous, such changes are usually seen on the scrotum, hands and arms. Even in these, growth is often quite fast and it is then quite impossible to make a definite clinical diagnosis between keratoacanthoma and squamous-celled carcinoma. These observations are of prime importance. Some common irritant contact at work is otherwise highly improbable because of the sex, age and site incidences.

It has been suggested that light may have some influence in these cases but this seems very unlikely as biotriptic skins are not unduly involved. There is no unduly high incidence in Australia and the lesions are rare on the hands.

Whatever the excitant the changes are neoplastic and are connected with the pilosebaceous follicle. Peterkin believes that this is a low-grade carcinoma. Belisario frankly includes it in his section on squamous-celled carcinoma. Rook points out its great similarity with many of the Peyton Rous phenomena. Haber declares it to be "histologically a pseudo-epitheliomatous downgrowth of the epidermis without the slightest evidence of malignancy."

Certainly the self-healing feature itself does not remove it from the carcinomata although it is so striking that there has been a tendency to believe that all growths which do so heal must be related one to another. The Ferguson Smith epithelioma is definitely a malignant growth and at times shows deep permeation of the lymphatics. Yet spontaneous healing is the rule. It should never be confused with keratoacanthoma either clinically or histologically. Abnormal mitoses and actual invasion of tissue-spaces occur. The growth is downwards so that the scars are much deeper than are those seen after molluscum sebaceum with its upward growth. On these points Ferguson Smith lays great stress.

Because we have all, since our student days, been familiar with the central and even peripheral healing which is seen in many rodent ulcers, even if not complete, this healing has been accepted without sufficient comment or enquiry. Rodent ulcers are relatively slow-growing in the vast majority of cases whereas it is the speed of development and the speed of regression which are so startling in molluscum sebaceum.

Although some references suggest a possible relationship with Poth's "tumour-like keratoses," where the multiple lesions arise on a background of actinic dermatosis, the lesions do not really resemble each other very closely.

Lyell recently drew attention to the warts which are single, rather like mole hills with domed tops. Their growth is accompanied by pain,

redness and swelling. These do suggest a close relationship with keratoacanthomata clinically, but they contain eosinophilic inclusion bodies. We have been unable to find such bodies in sections of molluscum sebaceum. For these tumours he revived the term "myrmecia."

One important point here is the fact that no scarring is left when warts disappear spontaneously, whereas scarring is the rule with molluscum sebaceum in similar circumstances.

The benign calcified epithelioma must be considered as a possible relative for it has some suggestive features. It usually affects the head and is seen mostly under the age of twenty years. When advice is sought the history is of about a year's duration. There is a round nodule in the cutis, about the size of a hazel nut. Malherbe regarded it as occupying an intermediate position between an epidermoid cyst and a basal-celled carcinoma. Linse, quoted by Ch'in, defined it as a papilloma growing in the closed cavity of a dermoid cyst. Gans regarded them as adenomata of sebaceous glands.

It would seem that an irritating agent, whatever its nature, acts on the pilosebaceous follicle, perhaps in a particular phase of its metabolism. A rapid hyperplasia of the cells results, the violence of the reaction diluting and destroying the cause. But if the reaction be not sufficiently destructive then the reacting cells may persist and be driven to active carcinomatous invasion, as suggested by Peterkin's cases.

Differential diagnosis

Confusion with molluscum contagiosum is more likely to occur because of the name rather than because of any clinical resemblance. These lesions are usually multiple (in fact, I cannot recall any patient showing but one lesion), and are seen as small shining beads sitting on the skin, each with its central operculum. They are less common on the face than elsewhere.

During their early development many keratoacanthomata have been diagnosed as warts. Occasionally the differentiation is difficult, but, of course, there are no true papillomatous skin changes, either filiform or seen as a pressure mosaic on the surface.

"Rodent ulcer" has been a common error, largely because the centre of the face is the site of election, because of the telangiectasia and because of the rolled edge seen in the older resolving keratoacanthomata.

The most difficult differential diagnosis can be from squamous-celled carcinoma and this is shown by the sequences leading to our knowledge of the condition. The greatest difficulty arises when the central eschar has separated to leave an ulcer with a raised edge. This edge, however, is definitely softer and spongier than is the edge of a true squamous-celled growth, and far softer than is the edge of a rodent ulcer.

Granuloma pyogenicum can be of the same size, of the same general appearance in its early stages and does, of course, develop rapidly, but

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the denudation of the surface and the obvious red mass of newly formed vessels and connective tissue, should give rise to no real difficulties.

Occasionally these growths have been removed under the diagnosis of "suppurating sebaceous cyst."

TABLE VIII
MOLLUSCUM SEBACEUM

Source	Treated surgically	Treated by Radiotherapy	X-ray Dosage	Surgery plus X-rays	Remarks
BEARE ..	38	33	500 to 1,200	30	Surgical methods include Excision, cutting Diathermy, Curettage, Curettage followed by Electrocautery, Diathermy or Silver Nitrate. Simple shaving off with cauterisation of the base. 1 Liquid Nitrogen
BOLAM ..	0	37	1,500 to 2,000	—	
MACKENNA ..	4	2	1,200	—	
PETERKIN ..	35	11	2,000 to 3,750	5	
ROOK ..	69	0	—	—	
SOMMERVILLE	12	0	—	—	
THOMSON ..	30	2	400	—	
VICKERS ..	34	4	—	—	
	222	89		35	

Gordon recommends a full course of X-ray, viz. : 6,000 R in split dosage over 10 days.

TREATMENT

Many cases have been allowed to run their course and to disappear spontaneously. When this has occurred some residual scarring is always seen. This is usually slightly depressed but becomes much less noticeable after a few years. If the growth shows signs of early regression, it is probably wise to leave well alone. Whittle indeed is a firm advocate of this view.

Others have used radiotherapy, in doses varying between 400 and 6,000 R. Gordon uses 6,000 R in split dosage over ten days, a full dose which itself necessarily leaves some scar. Most dermatologists have used between 500 and 2,000 R. Their results have been satisfactory, but it is to be remembered that the lesion has a limited life anyway. Indeed, Dalley tells me that it is her belief that radiotherapy really has but little influence on the course of the tumour. In some clinics X-ray treatment is the only treatment used (Bolam).

Many methods of direct destruction have been used, including even liquid nitrogen. Where complete excision has been possible, this has often been done and is the method advocated by Somerville. Simple curettage has been used, sometimes followed by electrocautery or by diathermy. Rook is convinced that simple curettage under local anaesthesia is the correct procedure, yielding the best cosmetic results. Vickers, too, prefers this method but uses silver nitrate as a caustic immediately afterwards. Simple shaving at skin level, followed by some form of local cauterization

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is the treatment advocated by Beare. Cutting and coagulation diathermy have been used. Belisario's method has not yet been extensively used in this country although he now uses it for the treatment of all early carcinomata. After curettage and light cauterization he paints the wound with 50 per cent. podophyllin in compound tincture of benzoin. Forty-eight hours later he applies, and thereafter continues to use, an ointment containing hydrocortisone and neomycin.



Reproduced by courtesy of V. M. Dalley

Fig. 8. Showing the scarring and loss of eyelashes following radiotherapy.

It is therefore obvious that most of us are convinced that some form of surgery is the treatment of choice. My own feelings on this point are so strong that many would state that I am grossly prejudiced. This may be so, but it is the result of seeing so many cases of radiodermatitis following therapy for some relatively unimportant condition. If we add thereto the possibility of subsequent histological control, then the case for direct surgery and preferably for complete excision, seems unanswerable.

ACKNOWLEDGMENTS

It is obvious that this paper has been made possible only by the active cooperation of my colleagues at King's College Hospital and even more particularly by my colleagues in dermatology. In fact, it is really a contribution by them and to all I am most grateful.

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PROCEEDINGS OF THE COUNCIL IN MAY

AT A MEETING of the Council on the 8th May, with Professor Sir James Paterson Ross, President, in the Chair, it was announced that Sir Russell Brain had accepted the Honorary Fellowship of the College.

The Jacksonian Prize was presented to Mr. B. B. Milstein, F.R.C.S.

A Hunterian Professorship was awarded to J. Bryant Curtis of Australia.

The Begley Prize was awarded to Mr. Robert D. Cohen, of the London Hospital Medical College.

Diplomas of Membership were granted to 148 candidates. Diplomas in Child Health were granted, jointly with the Royal College of Physicians, to 105 candidates.

The following hospitals were recognised under paragraph 23 of the F.R.C.S. Regulations :

HOSPITALS	POSTS RECOGNISED		
	General (all 6 mths.)	Casualty (all 6 mths.)	Unspecified (all 6 mths.)
LONDON—Hither Green Hospital, Lewisham			<i>Under para 23 (c) S.H.O. (E.N.T.)</i>
LONDON—Tilbury and Riverside General Hospital (Orsett Branch) (Additional)		Cas. Off.	

THE EXPERIMENTAL APPROACH TO THE PROBLEM OF THE CONGENITAL MALFORMATIONS

Arris and Gale Lecture delivered at The Royal College of Surgeons of England

on

28th January 1958

by

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SINCE I AM both a professional anatomist and a former student of St. George's Hospital, it might seem appropriate for me to open a lecture on the congenital malformations by saying something about the work of the most celebrated of all the Arris Lecturers and their successors, John Hunter. I shall, indeed, be alluding frequently to Hunter towards the end of my lecture: I begin, however, by referring you to a great contemporary of his. To do this, I must take you back to Easter Day, 1784, to a sitting room in Bolt Court off Fleet Street, within a few minutes' walk of this lecture theatre. In this room three men are engaged in an earnest conversation and their subject is not without a certain topicality today, for they are talking about the large number of new buildings which are being erected in London. The host, a large old gruff, obese and dogmatic man, has just remarked that in spite of the increase in living accommodation provided by all this building, the population has not risen. One of his guests, a stocky, black-visaged fellow-countryman of Hunter's, intervenes,

"I believe, Sir, a great many of the children born in London die early, but those who do live are as stout as any. Dr. Price says, they must be naturally strong to get through."

To this the host replies,

"That is system sir. A great traveller observes that it is said that there are no weak or deformed people among the Indians; but he, with much sagacity assigns the reason of this, which is, that the hardship of their life does not allow weak or diseased children to grow up. Now had I been an Indian, I must have starved, or they would have knocked me on the head when they saw I could do nothing."

In his reply to Boswell, Dr. Johnson sets out what is today perhaps the most important aspect of the whole problem of the congenital malformations. In the eighteenth century families were large, but in the great cities only one in every three or four children survived infancy. One can assume that the bulk of those afflicted with congenital deformities were carried off by the infectious diseases which cut such swathes through the ranks of their normal siblings. Now that the introduction of chemotherapeutic drugs and modern methods of infant management has reduced the neonatal mortality of the congenitally afflicted, without any parallel advance having been made in the prevention of deformities, we must

expect to witness the survival of handicapped children in ever increasing numbers.

The problem of congenital malformations, like that of cancer to which it bears striking similarities, has remained refractory because of our ignorance as to the aetiology. Because a number of deformities seem to show a predilection for certain families, it has often been hastily assumed that *all* the congenital malformations will some day be explained on a genetic basis. To this end, genetic theory has been strained and distorted to its limits, and, in order to explain the hereditary basis of some deformities and diseases, the term "genetic" is used in so wide a sense as to be virtually meaningless. Enlightened geneticists are beginning to realise the extraordinarily frail nature of the foundations upon which an immense superstructure of speculation has been erected. As I shall be returning to this theme later, I can do no better than quote from a most scholarly and unprejudiced paper by the American geneticists, David and Snyder (1954).

"It goes without saying that absolutely exhaustive exclusion of all environmental factors that might be relevant is at best an asymptotic possibility which can be approached, but not perfectly attained. Its attainment suffers both from functional limitations and from limitations of the imagination. In all areas of our behaviour we are constantly forced to be satisfied with something less than absolute certainty, and to accept and act upon provisional certainties."

I do not by any means intend to marshal the arguments against the genetic interpretation of the origin of the congenital malformations. I am content therefore to let the words of David and Snyder serve as my excuse for concerning myself this afternoon almost exclusively with environmental factors, and for describing to you the various ways in which it is possible to produce deformities in the mammal by experimental interference with the environment.

It is at this point that I return to Dr. Johnson's dictum to point out a wider implication which it has. For if it is true that in a savage community where life is nasty, brutish and short, none but the fittest survive, so the same law holds for that earlier and even more decisive environment, the uterus. For from the moment of fertilization, environmental factors play on the developing embryo. One of the most important and significant points about the whole difficult business of producing animals with congenital malformations is to grasp that it is only at a certain level of severity of interference with environmental factors in the mother that the birth of deformed young may be achieved. If the conditions are *too* rigorous, the embryos die and are resorbed. With less severe degrees of interference, they may be born dead at the end of a pregnancy of normal duration. If on the other hand conditions approximate too closely to normal, the young are born in a healthy and unblemished state. It is only, therefore, at a certain *rather low* level of interference that the birth

of live but deformed offspring occurs. It is this fact above all others which makes the new science of experimental mammalian teratology so time-consuming and tedious. The production of deformed young represents something which has almost but not quite come off, it is perhaps most accurately described as a reproductive near-success. The worker in this field travels along a narrow path, if he errs too much in one direction he gets no young at all, if he strays too far to the other side he gets litters of perfectly healthy normal animals. There is, however, this consolation. Once the conditions under which a malformation may be produced have been established, they tend to be remarkably constant for animals of the same species, and henceforward the deformity can often be reproduced at will.

Since there is only a tiny band in the whole spectrum of activity of any physical or chemical agent at which it possesses teratogenic properties, many important advances in the field of experimental teratology have been made *by accident*, when a chance arrangement of circumstances has brought it about that a teratogenic agent has acted in a pregnant animal in the right concentration at the appropriate period of pregnancy. It was such a combination of circumstances which marked my own introduction to this field and I shall describe it in some detail.

In 1953 it was noticed that the young of female rabbits which were maintained on a diet deficient in vitamin A at the Unit of Animal Reproduction at Cambridge were suffering from some form of neurological disease. The disturbance was characterized by abnormal posture with retraction of the head and defects in gait which progressed until there was complete paralysis of the lower limbs. Dr. James Millen and I investigated the condition and found that, in each case, the underlying disorder was hydrocephalus (Millen, Woollam and Lamming, 1953; 1954). It was particularly fortunate from our point of view that this accidental finding should have occurred in the course of an experiment in which the nutritional conditions were perfectly controlled, for the object of the experiments which Dr. Eric Lamming was carrying out in this colony was to determine the influence of maternal vitamin A levels on the number of young in the litter. There were available therefore control dams which were in receipt of the same diet as the experimental animals with the one exception that they were given a weekly dose of pure vitamin A acetate by mouth. We were quickly able to establish that hydrocephalus did not occur in the young of these animals and that it was therefore directly attributable to maternal vitamin A deficiency.

Shortly afterwards, through the generosity of the Nuffield Foundation, we were able to set up a large colony of rabbits which we maintained on a diet deficient in vitamin A, with appropriate numbers of control animals on the same diet with supplements of the pure vitamin.

From our study of this colony over a period of four years we were able to establish certain principles. The first was that the longer the mother

was on the deficient diet before mating, the greater the percentage of her young which would be hydrocephalic (Millen and Woollam, 1956). The second was that with severe degrees of deficiency the young would be still-born with hydrocephalus, but with milder degrees of hypovitaminosis-A they would be born alive and apparently healthy, developing hydrocephalus only after several weeks. With relatively slight vitamin A deficiency, the young would remain apparently normal without dilatation of the ventricles. Cisternal puncture of these animals disclosed however that each and all had a raised cerebrospinal fluid pressure (Millen and Woollam, 1957a).

This last finding suggested to us that it might well be that the real defect with which the young rabbits were afflicted was an elevation in the cerebrospinal fluid pressure, and that hydrocephalus was no more than a manifestation of this rise in pressure. We therefore embarked upon the study of the relationship between vitamin A deficiency and the cerebrospinal fluid pressure using the chick as the experimental animal. We found that, on a vitamin A deficient diet, the cerebrospinal fluid pressure of the chick increased with steady regularity by just over 1 mm. of water each day of its life (Woollam and Millen, 1956a). As an added refinement we kept hens on a diet deficient in vitamin A, and reared chicks from them. We found, somewhat to our amazement, that although these chicks started off with higher pressures than the progeny of hens on a normal diet, their cerebrospinal fluid pressures then followed the same line of regular increase at a higher level. If however we allow for the period the hen was on the deficient diet before the egg was laid, and add this to the period since the hatching of the chick, the result is a straight line corresponding almost exactly to that for the chicks hatched from eggs laid by hens on a normal diet (Woollam and Millen, 1956a). The remarkable fact is thus revealed that it does not matter whether it is the mother or the hatched chick which undergoes the deficiency, the end result on the cerebrospinal fluid pressure is identical.

Further experimental work in rabbits showed that it was possible to arrest the hydrocephalus by administering vitamin A to the afflicted animal. It was possible by this means to reduce a cerebrospinal fluid pressure of 500 mm. of water to normal, that is to under 100 mm. The damage to the brain was, of course, irreversible, and the ventricles remained paper-thin even though the animal lived on quite happily for months and in some cases over a year, without enjoying the use of much of his cerebral cortex (Millen and Dickson, 1957).

There are several points which emerge from our experiments on vitamin A deficiency as a teratogenic weapon which I would like to emphasize. First, the accidental nature of the original discovery. Secondly, the way in which it slowly became possible to establish conditions under which a virtually 100 per cent. incidence of hydrocephalus could be achieved. I would like also to draw attention to the fact that it is relatively easy to

carry out both cisternal puncture and ventriculography in these animals. By this means hydrocephalic rabbits can be obtained without any form of mechanical interference, to my mind a supreme advantage in any animal that is to be used for experimental surgery. They can be produced relatively cheaply with a near 100 per cent. incidence of the deformity. I would suggest therefore that to anyone interested in the surgery of hydrocephalus they offer very real advantages for experimental work.

There is one last point about this work which I feel I should mention. The question is always arising in experimental teratogenesis as to whether one is producing deformities on a strictly non-genetic basis or merely bringing out the effects of underlying genetic factors, that is evoking the expression of a gene. We used rabbits of many different breeds, Dutch, Flemish, English Chinchilla, &c., and we deliberately purchased the animals from breeders in widely separated parts of the country. We are convinced therefore that there can be no question of an *inbred strain* or mutation being involved. Of course, if one uses the word "genetic" in its widest sense, there may be something in the genetic inheritance of *all rabbits*, which is responsible for the occurrence of hydrocephalus under these dietetic conditions. I would stress therefore the close arithmetical relationship between vitamin A level and cerebrospinal fluid pressure, first because it is in such problems of fluid mechanics in embryonic tissues that the explanation of the mechanism of the congenital malformation seems most likely to be found, and, secondly, because it is becoming increasingly evident that it is at this level that gene action itself must also be investigated.

If I had more time at my disposal I might attempt to analyse and classify all the agents which are capable of producing congenital malformations in the young of experimental animals. I propose to shorten my task considerably by ignoring those agents which operate only on the developing eggs of fishes and amphibia. Whilst I do not wish to disparage in any way the usefulness of studies of the effects of teratogenic substances on the developing eggs of fishes, amphibia and birds, I feel that the information obtained from experiments in mammals such as the rat, rabbit and mouse, must have priority if one is to extrapolate the findings to the human.

METHODS AVAILABLE FOR THE EXPERIMENTAL PRODUCTION OF MALFORMATIONS IN THE MAMMAL

1. X-radiation

One of the great advantages of X-radiation is that it can be administered in a period of a few seconds to a few minutes, and therefore the time of onset of the teratogenic activity can be accurately timed. I say *time of onset* advisedly, because we do not know whether the *time of administration* of radiation denotes the time at which the damage is actually done or merely marks the onset of production of a noxious substance which is itself the teratogenic agent. It seems, however, that the effect is

a direct one on the foetus and is not mediated through the maternal tissues. Wilson (1954) has performed the experiment of exteriorizing the uterine horns of the pregnant rat on the anterior abdominal wall and exposing one horn to radiation and leaving the other untreated. In this way he has been able to establish that deformed young only occur in the irradiated horn. Although this experiment does not eliminate the possibility that the production of malformations depends on damage to the placenta, it does *suggest* that the effect of radiation is a direct one on the foetus, not mediated through the maternal tissues, nor, in any but the widest sense, an evocation of an underlying genetic factor. In the mammal the region of the body affected by deformities depends to a large extent on the day on which radiation is given. Thus, in general, deformities of the brain will develop from radiation early in pregnancy, but cerebellar defects are produced by radiation later in pregnancy (Hicks, 1953). Again, whilst the effect of radiation on the development of the limb bones of the mouse is at its most acute in the early stages of pregnancy, the palate is most severely affected by radiation on the thirteenth day (Russell and Russell, 1954). There are two possible explanations for this phenomenon. Either radiation produces a circulating toxin which only affects tissues when they are in a crucial stage of development, or there is a variation in the radiosensitivity of the tissues during development for some as yet unknown reason. Indeed, the tissues of the foetal rat brain will succumb to an amount of radiation on the eleventh day which two days later they can bear with impunity, whereas in the case of the kidney the position is exactly reversed, the thirteenth day being more critical than the eleventh.

2. Induction of hyper- and hypo-vitaminosis

In the Spanish and South American literature there have recently appeared a number of reports which claim that hydrocephalus can occur in young children through the accidental ingestion of large quantities of vitamin A. It might seem at first sight that this was in contradiction to our finding in the rabbit that vitamin A *deficiency* resulted in hydrocephalus. The explanation for this phenomenon resides, I believe, in a general principle of the action of vitamins in the developing embryo which I shall first state and then attempt to justify. The principle is this—if the embryo is to develop normally not only must all the vitamins be present, each vitamin must be available in a certain optimum concentration. The effects of the administration of a single vitamin cannot be considered without regard to the concentration of the other vitamins already present. Conversely, when we believe that we are studying the effects of a deficiency in a single vitamin, what we are really seeing is how the vitamins behave when one of their number is missing. One can produce cleft palate, for example, by inducing a deficiency of riboflavine or folic acid or administering a folic acid antagonist, but one can also produce it by administering large quantities of vitamin A (see Woollam and Millen, 1956b

for review). Again, the deformities produced by pantothenic acid deficiency are essentially the same as those which result from hypervitaminosis-A. The effects of a deficiency of pantothenic acid in the maternal diet may be greatly enhanced if the diet is supplemented with an excess of nicotinic acid, (Lefebvres-Boisselot, 1951). It seems, therefore, that if we disturb the vitamin balance in either direction, towards deficiency or excess of one or more vitamins, then the development of the embryo will be placed in jeopardy. It does not seem unreasonable to suggest that the optimum vitamin levels for the development of the young of any species must be closely related to the proportional distribution of the vitamins in the normal natural diet of that species. All the experimental work that has been done on the role of vitamins in development leads to one conclusion so far as human development is concerned, and that is this: if vitamins are to be given as a supplement to pregnant women then considerable care should be taken as to the relative proportions of the individual vitamins administered. Of course if the vitamins are given after the third month of pregnancy they can play no important part in producing or preventing the occurrence of congenital malformations, for the differentiation of the foetus is completed by the end of the third month. There remains, however, the possibility that vitamins have a synergic action with certain hormones, and this point I will be discussing later.

As a weapon in experimental teratology vitamin excess has overwhelming advantages over vitamin deficiency. It has indeed almost the precision of X-radiation as an instrument for producing congenital deformities. It is possible to institute a hypervitaminosis *during the course* of a pregnancy whereas vitamin deficiencies must generally be set in action by putting the dam on a deficient diet *weeks or even months* before the commencement of the pregnancy. By the use of hypervitaminosis-A one can choose from a range of malformations produced by the vitamin and induce that malformation by administering vitamin A to the dam on selected days during pregnancy. To produce defects of the eye, for example, vitamin A is given in the early part of pregnancy. Dr. Millen and I have used vitamin A excess as a tool for producing deformities of the brain, skull and palate in the rat. The first deformity we have studied is that which is most correctly called *exencephaly*. It is often misnamed *anencephaly*, but this is an incorrect use of the term for there is plenty of brain tissue present, albeit in a disorganized state. It looks as if the thalamus was thrust to the surface by some inner force and the third ventricle ruptured, the hemispheres being turned inside out and the chorioid plexuses actually free and presumably secreting into the amniotic fluid. When these animals are removed from the rat's uterus on the twentieth day of gestation they are quite active and show respiratory movements. They would however be eaten very quickly after birth by the mother if allowed to survive to term. The other deformity we have produced with the aid of hypervitaminosis-A is cleft palate. This deformity is confined to the posterior palate and is not accompanied by

hare lip. By administering vitamin A by stomach tube to rats from eighth to thirteenth days of pregnancy inclusive in single daily doses, 60,000 units, we were able to produce exencephaly in 6.8 per cent. of the young and cleft palate in 29.7 per cent. of the young.

3. The simultaneous administration of vitamins and hormones

Our main interest in this method of producing congenital malformations has been to use it as a baseline for the study of the interaction of other substances, mainly hormones or hormone antagonists, which are known to play a vital rôle in metabolism at the cellular level. As we follow the effects of various of these substances, singly or in combination, upon the teratogenic activity of vitamin A we obtain a picture, not only of the relationship of their metabolism to that of vitamin A, but also of their interaction one with the other. These experiments are, as yet, only in the preliminary stages, and when I say that already well over three thousand young have been examined for deformity you will see the magnitude of the task. But it does represent an attempt, however imperfect, to put the teratogenic activity of the vitamins and hormones on a quantitative as well as a qualitative basis, and to give to experimental embryological methods something of the precision of the biochemical approach.

Dr. Millen and I have employed a large number of substances in this way and our most interesting results thus far have come from the use of cortisone. In one set of experiments we have given 20 mg. of cortisone daily from the ninth to the twelfth days of pregnancy to rats which received massive oral doses of vitamin A daily from the eighth to the thirteenth days of pregnancy. The cortisone administration all occurred therefore within the period when the rats were saturated, as it were, with vitamin A. The effects of this treatment on the young of the rats was quite astonishing. The incidence of cleft palate rose from 29.7 per cent. to 100 per cent. when cortisone was given in conjunction with vitamin A. (Woollam and Millen, 1957). The less dramatic rise in the incidence of exencephaly to 36.6 per cent. (Millen and Woollam, 1957a), may perhaps be attributable to the fact that the critical period for the development of this deformity is on the eighth and ninth days, that is just at the onset of cortisone administration, whereas the critical period for the palate is during the latter half of the cortisone administration, that is on the eleventh and twelfth days. It is interesting to note that in these experiments and many others which we have conducted on the rat, there is no evidence that cortisone has any effect by itself as a teratogenic agent. It must be pointed out however that Fairstat (1954) has claimed that it is possible to produce cleft palate *in the rabbit* by the administration of cortisone alone. The conclusion we reached as the result of our experiments was that cortisone served in some way to sensitize the tissues to vitamin A and to *potentiate*, as it were, the action of the vitamin in the production of malformations.

ARRIS AND GALE LECTURE

The question naturally suggested itself as to whether this potentiating effect of cortisone was confined to vitamin A or applied to other teratogenic agents. Such evidence as we have supports the view that cortisone exerts a general rather than a specific action. Experiments have recently been completed which were designed to elicit whether cortisone played any part when radiation was used to produce malformations (Woollam, Millen, and Fozzard, 1957). In this study we used a dose of 258 r X-radiation applied to the anterior abdominal wall of rats on the eleventh day of pregnancy to produce deformities of the eye in the young. One group of animals received X-radiation alone, one group cortisone alone and one group cortisone together with X-radiation. Cortisone was given in the same dosage and at the same period of pregnancy as in the experiments with hypervitaminosis-A.

Group	Number of Dams	Number of Young	Number with Coloboma	Number with other eye Defects	Total Number with eye Deformities	Percentage with eye Deformities
1. Radiation only	12	77	1	3	4	5.2
2. Radiation and Cortisone	12	69	10	3	13	18.8
3. Cortisone only	12	74	0	0	0	0

(Fig. 1)

The results of our experiments are shown in table form (Fig. 1). The two points I would draw your attention to are, first, the absence of deformity in the group which received cortisone alone and, secondly, the much higher incidence of coloboma in the group which received both cortisone and radiation over that which received radiation alone. One interesting feature is that cortisone in this instance does not produce a shift towards the more severe type of deformity. It cannot therefore act by sensitizing the tissues to X-radiation with an effect comparable to that achieved more simply by increasing the quantity of radiation administered. It acts rather by bringing more embryos *into risk*, as it were, and thus increasing the likelihood that any given embryo will be affected by radiation. The action of cortisone in conjunction with radiation is therefore very similar to its action when given to animals subjected to the effects of hypervitaminosis-A. It potentiates the tissues to the effects of the teratogenic agent rather than simply serving to augment the action of that agent.

I have described how cortisone works in combination with both vitamin A and X-radiation: I want now to attempt the virtual completion of the circle by considering some experiments in which vitamins were given in conjunction with X-radiation. In these experiments (Woollam,

Pratt and Fozzard, 1957), the attempt was made to give precision by choosing a single deformity whose presence or absence could be demonstrated quite unequivocally. After a number of preliminary experiments we decided that the most suitable deformity to use as an index of teratogenic activity was anophthalmia. In a pilot study we varied the amount of X-radiation until we obtained an incidence of the deformity sufficiently definite to show a shift in one direction or the other when other factors were introduced. In some cases the anophthalmia was unilateral and in others bilateral. We decided therefore that the most satisfactory way of estimating the effect of radiation was to express our findings in terms of the number of absent eyes rather than as the number of affected foetuses. We formed four groups of virgin rats, twelve in each group. One group was set aside as controls, and received no treatment at all. Groups I and III received a massive dose of all the vitamins on the first day of pregnancy, both oil and water soluble vitamins being given, the water soluble in the form of *parentrovite*. In designing the injection the attempt was made to balance the vitamins in the proportions in which they occurred in the normal diet of the rat, so that each rat received what was equivalent to several months' supply of vitamins in a single injection. Groups I and II received X-radiation under identical conditions and in similar dosage.

Our findings were as follows. First, I think it is important to stress that neither the control group nor the group in receipt of vitamins alone showed any deformities. This, I suggest, goes a considerable way to disposing of two possibilities, one that anophthalmia was present as a mutant in the strain of rats used and, secondly, that the vitamin injection was directly teratogenic in effect. The positive feature to which I would draw your attention is the incidence of anophthalmia in the two groups which received radiation and in particular the much higher incidence in the group which received both vitamins and radiation. It would appear that the effects of radiation are greatly enhanced by a rich supply of vitamins, and, with this finding, the circle of inter-relationship between vitamins, cortisone and X-radiation is, somewhat imperfectly, completed. Much further work will be needed to analyse satisfactorily the interaction of vitamins, radiation and hormones. The results so far are, I believe, stimulating to thought not only in relation to the role of radiation as a teratogenic agent, but also in regard to the possible significance of hormone levels and diet to radio-therapy in malignant disease.

All the experiments which I have described have been concerned either with the production of malformations by the use of a teratogenic agent or with the augmentation of the effects of such an agent. The final group of experiments I am going to describe are of a different and perhaps one might say more optimistic nature. They are still in progress and I shall only give a brief outline of the results so far. Dr. Millen and I have recently tested a number of substances against vitamin A and cortisone to see if we could find any way of opposing the teratogenic activity of this

combination. I shall refer only to the rôle of one such substance, insulin. We gave insulin in doses of one to one-and-a-half units to pregnant rats which were subjected to the effects of cortisone and vitamin A or vitamin A alone. We also carried out a long series of control experiments which showed that insulin had no teratogenic effect in the rat. The results of administering insulin with cortisone and vitamin A were quite remarkable. Not only did insulin wipe out completely the potentiating action of cortisone, it also made inroads upon the teratogenic activity of vitamin A (Millen and Woollam, 1957b). Work now in progress is designed to elucidate the mechanism responsible for this anti-teratogenic rôle of insulin but the results so far are, I believe, worthy of consideration for two reasons. First, because it is heartening at last to discover the existence of anti-teratogenic as well as teratogenic substances. Secondly, because it has now become apparent that the teratogenic experiment offers an excellent field for the study of the interaction of hormones and vitamins with implications beyond those of embryonic development.

To anyone thinking of entering the field of experimental mammalian teratology, there is one piece of what, in my opinion, is essential *required reading*, an essay packed with acute observation and deduction. I refer to John Hunter's treatise on "Monsters." One of the most significant of Hunter's observations is the following.

"From the rarity of any peculiarity of malformations of any particular kind of animals, one would be inclined to believe that there is but one principle governing their formation."

Since the time when Hunter wrote those words almost every advance in our knowledge of the congenital malformations has seemed to emphasize their *separate* natures. The study of pathological anatomy has resulted in an increasingly minute subdivision and classification of the abnormalities. As the science of experimental teratology has developed and expanded, various environmental factors, rubella, anoxia and hyperoxia, X-radiation and maternal dietary insufficiencies have joined genetic factors in the list of possible causative agents. Experimental work with mutations in mice has suggested complex and minutely localized systems of organization for those deformities which are thought to have a genetic basis. The whole trend in the study of malformations since Hunter's day has been therefore towards fragmentation, so that to-day it would seem that, ideally as it were, any malformation which can be separately identified clinically ought to be regarded as a single discrete expression of the effects of a single causative agent. I believe that, to a considerable extent, this state of affairs is no more than a reflection of the long residence of the malformations under the genetic roof. Concepts such as those of variation in the penetration and expression of gene effects, epistasy and hypostasy, uncertain, failing and irregular dominance, multifactorial inheritance, either singly or in combination, make it possible to explain not only the congenital malformations but most of the phenomena of the natural world on a genetic basis if one is so inclined. In order to enable

the malformations to fit the strict Mendelian gospel the principle of the individual identity of some deformities has to be strained to breaking point. To take one example: if we consider the observation of Eggenberger (1928) that hydrocephalus, strabismus, eye defects, club foot and other congenital malformations are much more common in cretins than in the population at large, surely this can be inverted to the proposition that a certain type of thyroid deficiency expresses itself by the production of a number of congenital malformations, the most significant example of which is the condition we call cretinism, and others include hydrocephalus, club foot and defects of the eye. Or again, if we take mongolism. Although everyone can recognize a mongol on examination, even experts in this field seem to be hard put to explain exactly what *are* the definitive criteria on which it may be adjudged to be a mongol. It is agreed generally that cleft palate, congenital cardiac disease and other deformities are more frequent in mongols than in the population at large. Conversely there are stigmata of the mongol such as the slant eyes and epicanthic folds which are to be found elsewhere, as in this still-born hydrocephalic which Dr. Millen and I have examined (Fig. 2). If the presence of mongolism is to be ascribed to the interaction of a number of recessive genes, it is important to consider why their effect should also sometimes express itself in the form of abnormalities of the development of the palate and the heart. I do not want to carry this point any further, I hope to leave the impression that the distinction between the various deformities is far from clear-cut with one shading, as it were, into the other.



(Fig. 2)

One important feature of embryonic development which I have repeatedly stressed this afternoon is that each organ has its own sensitive period during development, so that, at this time, even a single teratogenic agent may produce a widely different range of deformity or groups of deformities by relatively small differences in the timing, extent and intensity of its effect.

If we try to visualize what goes wrong at a tissue level when a deformity is produced, it may be summarized as excessive cell growth or deficient cell growth. To give an analogy. One can disfigure a classical statue by taking a chisel to the nose or lips. If, on the other hand, one wanted to damage a piece of modern sculpture, one might be better advised to bring along a bucket of cement and disfigure the work by filling in rather than by subtraction. It is in these two ways, by over or under growth, that all deformities must arise, and there is no *intrinsic* difference at the cellular level between the process which produces a cleft palate and that which results in a congenital defect in the septum of the heart.

Here I must consider one of the most difficult of all the problems which surround the congenital malformations by putting a question in Hunter's words.

"Now why these foetuses should come to full growth excepting as to the part which may be deformed or defective, and not live after birth, is not easily explained."

There is no doubt that a very large number of still-born foetuses are deformed. It has, indeed, even been suggested that the *majority* of foetuses expelled at abortion are deformed. Although it is not possible to have figures on this subject, it has been said that, for every conception that ends in a live birth, there is one which fails somewhere along the line. Some pessimists even go so far as to say that it takes four or five pregnancies to produce a live birth. Yet a still-born anencephalic or hydrocephalic has come through right to term and then died at the last minute. The explanation may surely be analogous to that which has been arrived at from the results of animal experiments, the death of such deformed foetuses may represent a *parallel process* to that which produced their deformities and not an *end-result* of the deformities.

Just as I would stress the essential unity of the teratogenic agents and of the resultant malformations, so I would choose to emphasize the probability that all the malformations are the product of similar mechanisms. One has only to consider some of the findings of the experiments I have described. Vitamin A excess produces deformities, cortisone increases the teratogenic activity of the vitamin, and it also increases the teratogenic activity of X-radiation; vitamins increase the teratogenic activity of X-radiation, insulin opposes the teratogenic activity of cortisone and vitamin A. The picture suggested is one of multiple factors influencing a single process. Nor does there seem to be any reason to assume that genetic factors should be considered as belonging to an entirely different

category. Fraser, *et al.* (1954), have shown, and Dr. Millen and I have recently confirmed, that cortisone administration increases the incidence of cleft palate in a strain of mice susceptible to the deformity. That genes, vitamins and hormones are indeed closely associated I can best show by a quotation from a recent paper by David and Snyder (1954).

"In man who requires many vitamins and amino-acids, simple protein enzymes may be expected to be correlated with genes in a relatively simple manner, but the availability of co-enzymes is probably readily affected by nutrition. In general there appears to be no way of getting an enzyme into the cell except by building it there. Thus while the lack of certain enzymes may be due to improper nutrition or the effects of inhibitors, there may very well be a residue of diseases resulting primarily from gene-controlled absences of the basic patterns for requisite potent enzymes, for which there is no readily available cure in the usual sense."

It may well be that as we get to understand more of the mechanisms underlying the production of congenital malformations, the terms *genetic* and *acquired* will come to represent a distinction without a difference. Professor Crew has emphasized the significance of studies of human development.

"Children yet unconceived are as much the patients of the physician as are the moribund senescents on whom he is prepared to lavish his care."

Vitamins, genes, hormones, cell growth have been the main protagonists in the story I have attempted to unfold. I end by emphasizing the similarity between the problem of the origin of the congenital malformations and those other contemporary enigmas, the cause of cancer and the biological basis of ageing. It may be that the best hope for the moribund senescents on whom the physician lavishes his care lies in the study of the difficulties that must be surmounted by children yet unconceived.

ACKNOWLEDGMENTS

Virtually all the experimental work discussed in this lecture was carried out in collaboration with Dr. J. W. Millen, Reader in Anatomy in the University of Cambridge, whose generosity in allowing me to make free use of our joint material I gratefully acknowledge.

I must also express my gratitude to Dr. A. M. Barrett of the Department of Pathology, Cambridge, for the provision of the foetus illustrated in Fig. 2.

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APPOINTMENT OF FELLOWS AND MEMBERS TO CONSULTANT POSTS

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| E. SHERRAH-DAVIES, M.B., B.Chir. | Consultant Radiotherapist to the Christie (Cantab.), F.R.C.S., D.M.R.T. |
| P. J. CARTER, M.B., L.D.S.R.C.S., F.R.C.S., D.L.O. | E.N.T. Surgeon to the Edgware General Hospital. |
| D. M. BROOKS, M.B., F.R.C.S. | Orthopaedic Surgeon to the Barnet General Hospital. |
| B. L. DAY, B.M., F.F.A.R.C.S. | Anaesthetist to the King Edward Memorial Hospital. |
| H. L. LEECH, B.D.S., F.D.S.R.C.S., D.Orth. | Orthodontist to the Bedford, Luton and Hitchin and West Herts Group. |
| G. L. BUNTON, M.Chir., F.R.C.S. | Surgeon to the Northwood, Pinner and District Hospital. |
| J. W. LEWIS, M.B., F.F.A.R.C.S. | Anaesthetist to the Clare Hall Hospital. |
| A. F. FORBAT, M.B., F.F.A.R.C.S. | Anaesthetist to the Clare Hall Hospital. |
| R. J. H. SMITH, M.B., F.R.C.S., M.S., D.O. | Ophthalmic Surgeon to St. Mary's Hospital and North West Metropolitan Regional Hospital Board. |
| K. OWEN, M.S., F.R.C.S. | Surgeon to the Royal Northern Hospital. |
| M. W. J. GRUMMITT, M.B., F.F.A.R.C.S. | Anaesthetist to the West Herts and the Watford Hospitals. |
| J. WHITWELL, M.B., D.A., F.R.C.S. | Ophthalmologist to the Royal London Homoeopathic Hospital. |
| D. A. BAILEY, M.Chir., F.R.C.S. | Surgeon to the Barnet General Hospital. |
| J. L. ANDERSON, M.B., F.F.A.R.C.S. | Anaesthetist to the Edgware General Hospital. |
| W. C. ROBINSON, F.R.C.S. | Orthopaedic Surgeon to St. Charles' Hospital. |
| T. FAULKNER, M.B., F.R.C.S. | Plastic Surgeon to St. Charles' Hospital. |

The Editor is always glad to receive details of new appointments obtained by Fellows and Members, either through the Hospital Boards or direct.

DONATIONS

DURING THE LAST month the following generous donations to the Down House Fund have been received :

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|------|------------------------------|
| £500 | Sir Arthur Sims |
| £250 | Zoological Society of London |

FROM TRADE GUILD TO ROYAL COLLEGE *

The Inaugural Address delivered to the Abernethian Society of St. Bartholomew's Hospital

on
3rd October 1957
by

Professor Sir James Paterson Ross, K.C.V.O., LL.D., M.S., P.R.C.S., F.R.A.C.S.,
F.A.C.S.

IF YOU LOOK carefully at the inscription on the front of the Royal College of Surgeons of England—*AEDES COLLEGII CHIRURGORUM ANGLICI DIPLOMATE REGIO CORPORATI, A.D. MDCCC.*—you will notice that the word “*ANGLICI*” differs slightly from the others. Formerly the word had been “*LONDINIENSIS*” and the present appearance of the inscription provides visible evidence of the change in the title of the College which occurred in 1843. “The Royal College of Surgeons of London” was established by a Royal Charter granted by George III in 1800, and it may be assumed that this is as far back as one needs to go to understand the origin of the College. This, however, is a near-sighted view, and we must delve deeply into the history of the City of London if we are to obtain a true picture of the ancestry of the College, and of the events and developments extending over several centuries which led to the establishment of the College on its present site.

Accurate details of the history of London in the Middle Ages are not easily obtained, but it is clear that in the thirteenth and fourteenth centuries there was a steady growth in the size and influence of a “middle-class” of craftsmen who formed craft or trade guilds which were the predecessors of the City Companies. The guilds were started to regularise the practice of the particular calling; to lay down rules for the appointment, training and discipline of apprentices; to safeguard the rights and privileges of members; and to perform certain religious duties. They obtained the right of using a particular livery.

Such a guild or confraternity of surgeons was formed by the military surgeons who served in the Hundred Years War (1337-1444), but the earliest known charter concerning surgeons is that granted to the Barbers' Company by Edward IV in the year 1462. No doubt the Guild of Surgeons had little or no authority in the City because of its small membership—the records show that in 1491 there were eight, and in 1513 only twelve members—yet it is strange that the Barbers' Charter should deal almost exclusively with surgery, as though this craft were entirely in the hands of the Barbers. The charter states that the free men of the Mystery of Barbers (mystery is the same word as the French *métier*) had for long exercised “the Mystery or Art of Surgery, as well respecting wounds,

*Reproduced from *St. Bartholomew's Hospital Journal*, December 1957, Vol. LXI, pp. 369-377, by kind permission of the Editor.

bruises, hurts, and other infirmities of our liegemen, and healing and curing the same, as in letting blood, and drawing the teeth of our liegemen." It further stated that through the ignorance, negligence and stupidity of the unskilled "very many and almost infinite evils" had befallen our liegemen; and so the Charter was granted for the purpose of remedying these evils, and charged the Company with the superintendence, scrutiny, correction and government of freemen of the City being Surgeons and exercising the Mystery of Barbers, and of all other foreign Surgeons practising in the City of London and its suburbs.

It may be asked how it ever came about that the practice of surgery was in the hands of the barbers. In the Middle Ages the clergy were the physicians, but as time went by the priests began to feel the competition of Jewish physicians and lay surgeons. The Jews were thwarted by their patients being excommunicated; but all the Church could do to the lay surgeons was to brand surgery as an inferior and derogatory calling, and to forbid priests to undertake any operation which involved the shedding of blood. Rather than allow the control of surgery to slip from them the priests selected their servants, the barbers, who were known to be dexterous with sharp instruments, not only to shave their tonsures but also to be taught the surgical art under their direction. These pupils of the priests became Barber-Surgeons.

It has already been pointed out that the surgeons, though men of a better class and with attainments of a much higher order than the barber-surgeons, were too few to gain any authority in the City, so they attempted to establish themselves by union with the Physicians. A conjoint College of Physicians and Surgeons was formed in the City under the authority of the Mayor, but this arrangement proved unsatisfactory because the physicians, most of whom held University degrees, looked down upon the surgeons who were less well educated, yet were constantly striving to raise the standard of their craft and to inculcate high ideals in regard to responsibility towards their patients. As an example of this one may quote the regulations made about the middle of the fifteenth century, whereby four members of the Guild were elected Masters, whose duty it was to supervise the craft, to inspect apprentices, to punish malpraxis, and to be available for consultation in cases of serious illness—in fact it was an offence for a surgeon to fail to call in the Master under such circumstances.

The Conjoint College did not last long, but the surgeons were unable to exist alone and therefore agreed to combine with the Barbers. A charter was granted by Henry VIII in 1540 to the Surgeons and Barber-Surgeons, but it must be understood that the combined company consisted of Barbers, Barbers practising Surgery, and Surgeons. The Charter gave the Surgeons control over the Barbers practising Surgery, and by the rules of the Company surgeons were not allowed to practise shaving, and barber-surgeons were not allowed to do more than draw teeth. If

any of the barbers became surgeons it was only after some years of apprenticeship, attendance at lectures and demonstrations, and obtaining the Bishop's licence.

We see in the establishment of these Guilds and Companies a sense of high responsibility and a desire to set up good standards of service to the public or, as in this case, to patients. This is borne out not only from the study of the rules and records of the Companies, but also from the writings of their prominent members. To read these records of the thoughts and ideals of men of a by-gone age helps to keep us humble; so often we may be inclined to think that because they knew less than we do, and their methods were more crude, that they must have been not only ignorant, but brutish. In fact, we have not out-grown their faults, and we cannot improve upon their noble ideals; it was their fine character that has made their names survive.

The first Master of the Company of Barber-Surgeons was Thomas Vicary, Sergeant Surgeon to King Henry VIII and a Governor of St. Bartholomew's Hospital. It is sometimes stated that he was Surgeon to the Hospital, but although he played an outstanding part in the life of the Hospital for many years, and may have exercised supervision over the duties of the surgeons, as over much of the rest of the work of the Hospital, he was not appointed one of the four surgeons to the hospital at the time of its second foundation. Vicary wrote *A Profitable Treatise of the Anatomie of Man's Body*, a book which had little merit as far as anatomy was concerned, since it was merely a translation of an ancient text, but is most valuable as an indication of what Vicary regarded as the attributes required in a man who would be a surgeon. "Four things most specially that every surgeon ought to have—

"The first, he ought to be learned and that he know his principles, not only in Chirurgerie, but also in Phisicke, that he may the better defende his Surgery; Also he ought to be seene in natural Philosophie, and in Grammar, that he speake congruitie in Logike, that teacheth him to prove his proportions with good reason. In Rethorike, that teacheth him to speak seemely and eloquently; also in Theorike, that teacheth him to know things naturall, and not naturall, and things agaynst Nature. Also he must know the Anatomie, for al Authors write against those Surgions that worke in mans body not knowing the Anatomie, for they be likened to a blind man that cutteth in a vine tree, for he taketh more or lesse than he ought to doo . . . it is as possible for a Surgion (not knowing the Anatomie) to work in man's body without error, as it is for a blind man to carve an image and make it perfy.

"The second, he must be expert . . . he oughte to knowe and to see other men work and after to have use and exercise.

"The thirde, that he be ingenious or witty; for al things belonging to chirurgerie may not be written nor with letters set forth.

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"The fourth, that he must be wel manered, and that he have al these good conditions here following—that a Chirurgeon must take heed to deceive no man, with his vayne promises, nor to make of a smal matter a great, because he woulde be accounted the more famous. . . . Likewise they shal give no counsayle except they be asked, and then say their advise by good deliberation, and that they be wel advised afore they speake, chefly in the presence of wise men. Likewise they must be as privie and as secrete as any Confessor of al thingis that they shal eyther heare or see in the house of their pacient. . . . And see they never prayse them selves for that redoundeth more to their shame and discredite than to their fame and worship ; For a Cunning and skilfull Chirurgion neede never vaunt of his doings, for his works wyll ever get credite ynough. Likewise that they despise no other Chirurgion without a great cause ; for it is mete that one Chirurgion should love another, as Christe loveth us al."

We begin now to understand what we mean when we say that the Royal College of Surgeons has inherited a great tradition, and why it is that we trace our origin back to the old Guilds.

Though the association with the Barbers gave the Surgeons more power in the City, it was otherwise to their disadvantage, especially in their relations with the Physicians, who regarded it as a sign of their inferiority and forbade surgeons to prescribe for their patients. Not till Abernethy's time did surgeons obtain this right. In spite of the special privileges which the Barbers allowed to their surgical brethren—for example, at meetings of the Court of the Company, after the general business was over the Barbers would withdraw and leave the Surgeons to discuss their own professional affairs in private—the union was on the whole an unhappy one and was dissolved in 1745, when the Surgeons were incorporated as a separate Company with their own Surgeons' Hall in Old Bailey. Here lectures were given in Anatomy and Surgery by Percivall Pott and later by his former pupil John Hunter, but as the century neared its close the affairs of the Company went from bad to worse. It was difficult to find lecturers and to obtain audiences for them ; interest was lacking in the general well-being of the Company ; and there were even complaints about the conduct of the examination of the Surgeon's mates for the Navy.

It is important to note the association of the Company with the Navy, for the Court not only examined candidates for the medical service but also acted as a tribunal to assess the claims made by Naval officers for compensation or pensions for wounds and " hurts." Among the treasures at the College of Surgeons there is the record of a claim made by Admiral Sir Horatio Nelson for his surgical treatment when he lost his arm. The anchor on the College Coat of Arms bears witness to this link with the Royal Navy.

It seems strange that interest in surgery should have flagged at a time when John Hunter was so busily introducing the method of experiment

into the study of surgery and placing the subject on a sure scientific foundation. It seems clear that although a few men like Astley Cooper appreciated his leadership the majority heedlessly continued to follow the old-fashioned empirical practices, and the teaching of surgery at Surgeon's Hall languished and finally died when the Company was dissolved in 1795. Within five years, however, the Royal College of Surgeons came into being, charged by Royal Charter with "the promotion and encouragement of the Study and Practice of the Art and Science of Surgery." The building of the College in Lincoln's Inn Fields was designed to contain John Hunter's museum and a library; the greatly expanded museum and library are still among the principal concerns of the College to-day.

The original College buildings which were completed in 1813, soon proved inadequate to house the steadily increasing number of specimens which successive Curators, following the Hunterian tradition, were adding to the collection. The building was therefore enlarged in 1835, and again in 1855 and 1891, but the only departments represented were Anatomy and Pathology. In 1931 Sir George Buckston-Browne presented to the College a "Farm" adjoining Darwin's house at Downe in Kent, which consisted of a residence for research workers, farm buildings to house large as well as small animals, and a laboratory suite with an operating theatre. Excellent surgical experimental research was conducted at the Farm under the direction of Sir Arthur Keith, the first Master.

In 1937 a further extension was made to the College itself when, thanks to the generosity of the Bernhard Baron Trustees, another floor was added to the main building to accommodate a research department of Physiology. When war broke out in 1939 the activities of the College, which had been steadily increasing, were brought to a halt, and its treasures, the pictures, much of the library, and the most valuable of the Hunterian specimens were sent away for safe keeping in many parts of England and Wales. On the night of 10th-11th May 1941 the College suffered very serious damage in an air raid, and although the front of the building in Lincoln's Inn Fields was less severely affected all the museums on the Portugal Street side were completely gutted.

When building operations became possible after the war, the Council of the College decided that in order to provide for the expanding activities in the fields of post-graduate education and scientific research it would be useless to rebuild on the previous plan. Though the Hunterian Museum and the Library were still the chief concerns of the Council, accommodation had to be found not only for new museums but also for lecture rooms, demonstration rooms, and research laboratories in the departments of Anatomy, Physiology, Pathology and the newly-formed department of Pharmacology. Furthermore, the Faculty of Dental Surgery and the Faculty of Anaesthetists, both recently established, also required laboratory and office accommodation. These new departments, and the Nuffield

FROM TRADE GUILD TO ROYAL COLLEGE

College of Surgical Sciences, which is a residence for eighty students, accounts for the enormous building operations now proceeding on the south side of Lincoln's Inn Fields.

Although the scientific departments are not yet properly housed, members of their staffs are already engaged on many problems which have a direct bearing upon clinical surgery. In the Anatomy department the minute structure of nerve cells is being studied using an electron microscope supplied by the British Empire Cancer Campaign. In the Physiology department most interesting work is being done upon the physical and chemical factors which influence the healing of wounds, and valuable electromyographic studies are being carried out on the muscles of mastication in relation to orthodontics. The vasomotor control of the nasal mucosa is being investigated with a view to elucidating allergic reactions in the nose. The Biochemistry sub-department is engaged in research upon lipid metabolism. The workers in the department of Pathology are carrying out research into carcinoma of the lung, and also into disorders of collagen formation, and in the department of Pharmacology important research is being done to study regeneration in the autonomic nervous system, and the effects of ganglion-blocking agents. At the Buckston-Browne Farm, work of fundamental importance has been done on skin grafting and on organ transplantation, and recently a team of research workers has been making excellent progress with the extracorporeal circulation.

One of the conditions on which the Hunterian Collection was delivered to the Company of Surgeons provided that "one course of Lectures, not less than twenty-four in number, on Comparative Anatomy and other subjects, illustrated by the preparations, shall be given every year by some Member of the Company." In spite of a promising start, as years went by history repeated itself and the difficulty of finding a suitable lecturer each year again led to the suspension of the lectures. Therefore application was made for permission to alter the conditions, and in 1894 the Lords of the Treasury agreed that each year one course of Lectures not less than twelve in number should be given by Fellows or Members of the College, and since that time applications for Hunterian Professorships have become steadily more numerous so that now there is intense competition for the twelve appointments and an astonishing amount of excellent material is offered by applicants, even by the unsuccessful ones.

There are many other named surgical Lectureships in addition to the Hunterian Professorships, and the College now has an organisation for arranging courses of lectures in surgery for post-graduate students at regular intervals throughout the year.

The College Departments of Anatomy, Physiology, Pathology and Pharmacology, also play their part in University education, as teaching departments in the Institute of Basic Medical Sciences of the British Post-graduate Medical Federation in the University of London. This intimate

association with the University enhances the academic status of the departments, and provides some very welcome financial assistance. It will be understood, therefore, that the cost of the educational programme does not fall entirely upon the College and its Fellows.

A function which the College has inherited from the Court of the Barber Surgeons' Company and from Surgeons' Hall is to "test the fitness of persons" to practise surgery. The Court of Examiners which is elected by the Council is entrusted with the maintenance of the high standard traditionally associated with diplomas granted by the College.

Let me repeat that the College was founded by Royal Charter and is justly proud of being a Royal College. It has been privileged and honoured by a close association with the Royal Family, and the visit paid by Her Majesty Queen Mary to see the effects of the bombing in 1941 is gratefully remembered. Many members of the Royal Family, including Her Majesty The Queen and Prince Philip, Duke of Edinburgh, have graciously accepted the Honorary Fellowship, and the College was particularly favoured when The Queen laid the Memorial Stone of the new buildings just before her Coronation.

Finally, it must be realised that since the Royal College of Surgeons attracts post-graduates in large numbers from overseas, it constitutes and will always continue to maintain a vital link between England and the Commonwealth.

OVERSEAS VISITORS TO THE COLLEGE

RECENT OVERSEAS VISITORS to the College have included Professor R. M. Janes, Hon.F.R.C.S., of Toronto, Sir Arthur Sims, Commonwealth Travelling Professor for 1958, and Mrs. Janes, who stayed in the College on their way home from Africa: Dr. H. Rocke Robertson, who delivered a Moynihan Lecture in the College, and Mrs. Rocke Robertson of Vancouver: Mr. A. G. Jessiman, F.R.C.S., of the Peter Bent Brigham Hospital, Boston, who delivered a recent Hunterian lecture: and Dr. J. W. Pearce of London, Ontario, who attended the monthly dinner in May.

ANATOMICAL MUSEUM

THE SPECIAL DISPLAY for the month of June consists of specimens illustrating John Hunter's discoveries.

LIFE OF SIR GEORGE BUCKSTON BROWNE, F.R.C.S.

A BIOGRAPHY HAS been written of Sir George Buckston Browne, one of the greatest benefactors the College has had, by Miss Jessie Dobson, B.A., M.Sc., and Sir Cecil Wakeley, Bt., K.B.E., C.B., LL.D., F.R.C.S. The publishers are Messrs. E. & S. Livingstone and the price of the book is 25s. net.

**ANNUAL MEETING OF THE ASSOCIATION OF SURGEONS OF
GREAT BRITAIN AND IRELAND. BELFAST, 10TH-12TH APRIL
1958**

THE ASSOCIATION OF SURGEONS last held a meeting in Belfast twenty-seven years ago, on that occasion under the presidency of Andrew Fullerton. His Assistant Surgeon in those days was Mr. Ian Fraser, who appropriately enough became President of the Association this year.

From every point of view this was a meeting to remember, for the association was made welcome in the city in a quite remarkable way, while the scientific contributions were outstanding.

Thursday 10th April

At the brief business meeting a recommendation of the council to bestow Honorary Fellowship upon Professor R. Danis of Brussels and Professor P. Santy of Lyons was approved with acclamation, and Professor Danis was welcomed personally.

The scientific meeting then began with a group of short papers on surgical aspects of disorders of the liver, contributed by Mr. Michael Hobsley, Professor R. Milnes Walker, Mr. Alan Hunt, Dr. Sheila Sherlock, Mr. J. J. Mason Brown and Mr. O. V. Lloyd-Davies.



Reproduced by courtesy of the Belfast Telegraph

The President of the Royal College of Surgeons of England, Professor Sir James Paterson Ross, talking to the President of the Royal Society of Medicine, Sir Clement Price Thomas, during the meeting of the Association of Surgeons which was held in Belfast in April.

These contained much that was new and much that was important. In particular the immediate and long-term treatment of portal hypertension with bleeding, the risks of hepatic coma and its anticipation and treatment, the anatomical basis and likely place in surgery of segmental hepatectomy, and the timing of surgical intervention in neo-natal obstructive jaundice were examined in detail.

While these papers were being given, a programme of surgical films was also shown and during the rest of the meeting Fellows were able to arrange special showings of those they wanted to see again.

Luncheon was generously provided by the Northern Ireland Hospitals Authority. In the afternoon, operations could be attended at various hospitals and in the Royal Victoria Hospital a number of demonstrations had been arranged, including in particular a demonstration of clinical cases and a clinico-pathological demonstration, at both of which cases were shown of exceptional interest. These and other demonstrations throughout the meeting owed much to the enthusiasm and ability of Professor Harold Rodgers.

Later in the evening the pleasantly informal university reception was greatly enjoyed.

Friday 11th April

The morning was devoted to short papers contributed by workers in Belfast. These were all first rate and it is hardly fair to pick out for special mention any one of them, but it must be said that Dick Wellbourn's short, lucid account of adrenal failure was one of the important contributions of the meeting.

Luncheon provided another unique occasion, for Fellows of the Association were the guests of the Prime Minister and Government of Northern Ireland at Stormont House. Mr. J. L. O. Andrews, the Minister of Health, presided, and his graceful speech was responded to by Sir Ernest Finch.

In the afternoon a large audience in the main lecture theatre watched on closed-circuit television a ward round taking place in the Royal Victoria Hospital and even accompanied a distant surgeon down a bronchoscope and up a sigmoidoscope (is there no privacy left?).

This very successful day ended with yet another example of Belfast hospitality for the Lord Mayor and Corporation gave a dinner to the Association at the City Hall.

After dinner, toasts were proposed and replied to by the Governor of Northern Ireland, Lord Wakehurst, the Prime Minister of Northern Ireland, Viscount Brookeborough, the Lord Mayor of Belfast, Alderman Cecil McKee, the acting Vice-Chancellor of the University, Professor Francis Newark, Mr. Ian Fraser, President of the Association, and, proposing "The City and Corporation of Belfast," Sir Gordon Gordon-Taylor, who with wit, scholarship and charm, made the speech of the evening.

Saturday 12th April

A very fine paper by Mr. A. L. d'Abreu on the results of mitral valvotomy stimulated a lively discussion. This was followed by Sir Gordon Gordon-Taylor on the results of hind-quarter amputation. It is betraying no secrets to report that a certain amount of persuasion had proved necessary in respect of this contribution, Sir Gordon fearing to embarrass his friends with an unwanted paper ! In fact, as the Council had correctly anticipated, not only was this masterly paper greatly appreciated, but the Association welcomed an opportunity of showing a great man, the only British Honorary Fellow, a little of the regard and affection he has come to command. It is unlikely that anyone present on this Saturday morning as the meeting rose to him will forget " Sir Gordon's day " as Mr. d'Abreu had appropriately called it.

Other papers were upon hyperparathyroidism and renal stones (Dr. Mary McGeown and Mr. E. M. Morrison) and upon transplantation of the ureters (Mr. W. T. Irvine and Mr. L. N. Pyrah), fine papers and a fitting end to the scientific meeting.

Luncheon was with great generosity provided by the Northern Ireland Hospitals Authority after which various sporting activities broke out and continued over the weekend.

Yes, quite certainly a meeting to remember and one which has set a very high standard by which future meetings may be judged.

COLLEGE PUBLICATIONS

READERS ARE REMINDED that the following publications issued or sponsored by the College may be obtained from the Editorial Secretary, Royal College of Surgeons of England, Lincoln's Inn Fields, London, W.C.2.

Lives of the Fellows, 1930-1951. By the late Sir D'Arcy Power, K.B.E., F.R.C.S., Honorary Librarian, and continued by W. R. Le Fanu, M.A., Librarian.

A single volume, bound in blue cloth, of 889 pages, containing the Lives of all Fellows known to have died between 1930 and 1951. £2 2s. 0d. post free.

A Record of the Years from 1901 to 1950. Edited by Sir Ernest Finch, M.D., M.S., F.R.C.S. A slim volume, illustrated, containing a brief history of the College between the centenary and the 150th anniversary of the foundation with lives of all the Presidents since 1900, written by special contributors from their personal knowledge. In red cloth 9s. post free or red paper covers 5s. 6d. post free.

John Hunter, a List of his Books. A short-title bibliography of all known editions of John Hunter's books, compiled by the Librarian. Printed at the Cambridge University Press, and bound in green cloth. 2s. 6d. post free.

**William Clift.* By Jessie Dobson, B.A., M.Sc., Anatomy Curator. A new biography, fully illustrated, of the first Conservator of the Museum at the College. Published by William Heinemann Medical Books Ltd. Bound in blue cloth; 144 pages with frontispiece portrait and 31 plates. 8s. 6d. post free.

*A separate cheque for this publication would be appreciated.

BOOKS ADDED TO THE LIBRARY, JANUARY - MARCH 1956

- Anatomy :**
 FRAZER. Anatomy of the human skeleton, Fifth edition, by Breathnach. Gift of Mr. H. J. B. Atkins.
- Anaesthesia :**
 SEWARD AND BRYCE SMITH. Inhalation anaesthesia in childbirth.
- Biochemistry :**
 BALDWIN. Dynamic aspects of biochemistry. Third edition.
 BRACHET. Biochemical cytology.
 DEUEL. The Lipids, Vol. 3.
 NABARRO. Biochemical investigations in diagnosis and treatment.
 NATIONAL FOUNDATION FOR INFANTILE PARALYSIS (U.S.A.) Symposium on cellular biology, nucleic acids, and viruses. Gift.
- Cancer :**
 CURRIE. Endocrine aspects of breast cancer.
 HOMBURGER. Biologic basis of cancer management.
 HUXLEY. Biological aspects of cancer.
 NIMEH. Gastro-duodenal ulcer and cancer. Author's gift.
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BRECELJ. Ratna hirurgia. Belgrade 1953. Two Vols. Gift of Sir Russell Brock.

DEMPSTER. Introduction to experimental surgical studies. Author's gift.

ROB AND SMITH. Operative surgery, Vol. 6. Gift of Mr. M. L. Formby, in continuation.

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Medical Essays :

EDMUNDS AND SCORER. Ideals in medicine. Gift of Christian Medical Fellowship.

PARKES WEBER. Medical teleology. Author's gift.

Reference Books :

WORLD HEALTH ORGANISATION. International classification of diseases. 1958. Two volumes.

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Historic Texts :

KEILL. An account of animal secretion. 1708.

KEILL. Anatomy of the humane body. Fourth edition. 1710.

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VACCINATION BROADSHEETS (2). Leeds 1804-5. Gift of Sir Geoffrey Keynes.

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PAGEL. Biographisches Lexikon hervorragender Ärzte des 19ten Jahrhunderts, 1901.

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SIMPSON SMITH : Higgins. Alexander Simpson Smith 1900-1942. Gift of the author, Mr. T. Twistington Higgins.

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BINDING CASES ARE not provided for completed volumes of the ANNALS but the Editor can recommend the firm of Lovett, Bookbinders, 86, Plashet Grove, London, E.6, who will undertake the binding in buckram or leather to individual requirements at reasonable prices.

RESTORATION AND REBUILDING OF THE COLLEGE

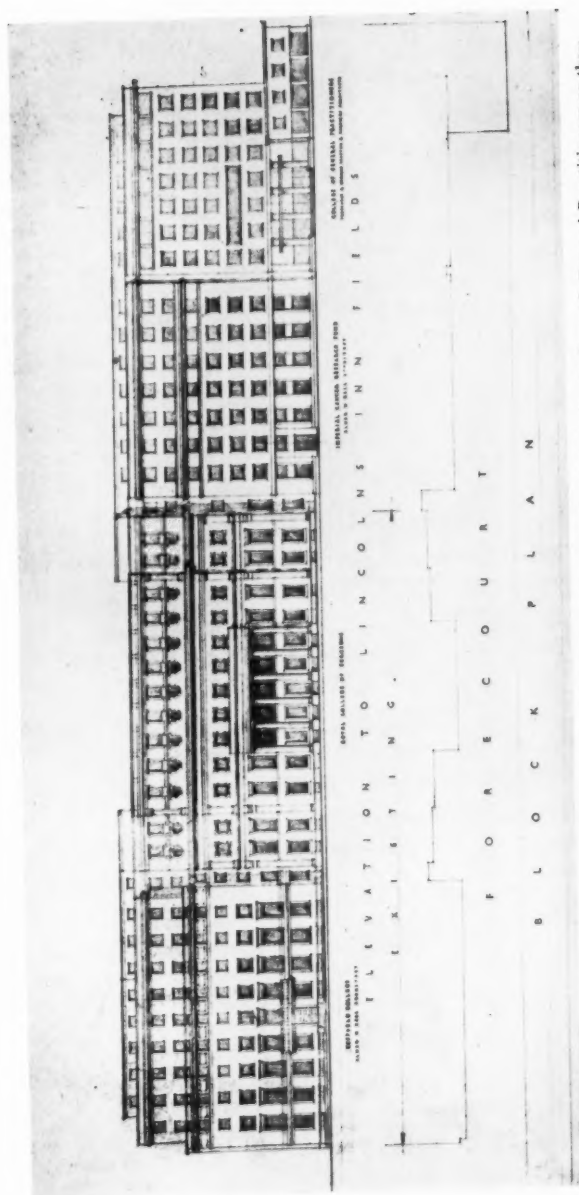
The scheme seen as a whole

THE LINE DRAWING reproduced in this number of the ANNALS indicates the future appearance of the College and two of its allied institutions when the buildings have been completed. These buildings will occupy the whole of the south side of Lincoln's Inn Fields except for the extreme east end of the site (off the left-hand end of the picture) where the Land Registry stands.

The small scale of the drawing and the absence of colour make it a little difficult to distinguish the different parts of the buildings, but the main block of the College will be recognized by its slightly lower roof flanked by the two tower-like erections surmounting the wings. In reality the main College will be far more easily distinguishable by reason of its façade of stone (part real and part artificial) contrasting with the other buildings all of which will be of brick with stone facings. The portico, the College's most prominent feature, is relatively inconspicuous in the picture, whereas in fact it projects fourteen feet from the building, and the flanking buildings will also come forward thus far from the line of the main College front.

The next block to be erected will be the research laboratories of the Imperial Cancer Research Fund, immediately to the right (or west) of the main College building, and intercommunicating with it. The planning authorities stipulated that this laboratory building should be symmetrical in mass, though not necessarily in detail, with the Nuffield College (which, as readers of the ANNALS will be aware, has been in use for eighteen months). It is interesting to note how the Architect, Mr. Alner W. Hall, has complied with this stipulation and overcome the difficulty of a site shorter by two bays and an instruction to plan nine, instead of eight, floors, between ground and roof. The shorter frontage will be somewhat disguised by the presence of the adjacent College of General Practitioners which is to be built in a somewhat similar style, and the additional floor will be gained in the lower part of the structure, where the Cancer Fund building, consisting almost entirely of small laboratories, will not need the larger (and consequently higher) rooms which are required at ground and first floors of the Nuffield College. The principal aids to symmetry are the uniform height and building materials, and the constant level of the cornice line which runs throughout the length of the Nuffield College, main College, and Cancer Fund buildings.

The College of General Practitioners are served by different Architects, Messrs. Trehearne, Norman, Preston & Partners, but they have the same Consulting Architect as the Royal College of Surgeons, namely Sir Edward Maufe, and it is apparent from the picture that the architectural



The buildings of the Royal College of Surgeons, Imperial Cancer Research Fund and the College of General Practitioners as they will eventually appear.

RESTORATION AND REBUILDING

style of the buildings will be very much similar. The bricks will be pale in colour for so long as the London atmosphere permits (and it is to be noted that the College is now in a smokeless zone). The frontage line for the main part of the building is the same as that of the Nuffield College and Cancer Fund, but the extreme right hand end will come forward to the pavement: the part referred to is that which has four large windows on the ground floor and four small windows above. The final development of this extreme end of the site must be regarded as uncertain by reason of the property not being "in hand."

In general these buildings will not only fulfil their purpose—the formation of a medical centre of the highest importance, but will bring architectural harmony to Lincoln's Inn Fields. They will conform with the prevailing building materials of the Square, brick and stone, and will result in a more or less constant height in the buildings running the length of the south and south west parts of the square, a height worthy of the spacious proportions of Lincoln's Inn Fields.

SAYINGS OF THE GREAT

"A man has always to be busy with his thoughts if anything is to be accomplished." *Antony van Leeuwenhoek* (1632-1723).

"I have weighed in a nice and scrupulous balance whether it be better to serve men or to be praised by them, and I prefer the former." *Thomas Sydenham* (1624-1689).

"The practice of medicine is an art, not a trade: a calling, not a business: a calling in which your heart will be exercised equally with your head." *Willian Osler* (1849-1919).

(Contributions are invited.)

DIARY FOR JUNE

Mon. 16		Anaesthetic Course begins.
	9.30	DR. A. I. PARRY BROWN—Anaesthesia for thoracic surgery.
	11.00	DR. A. I. PARRY BROWN—Anaesthesia for cardiac surgery.
	2.00	MR. L. P. LEQUESNE—Fluid balance—I.
Tues. 17	3.30	MR. L. P. LEQUESNE—Fluid balance—II.
		Names of candidates (L.D.S.) for election to the Board of Faculty of Dental Surgery announced.
	9.30	PROF. W. D. M. PATON—The actions of anaesthetics.
	11.00	PROF. W. D. M. PATON—Principles of peripheral autonomic action.
	2.00	PROF. W. W. MUSHIN—Some aspects of physics in relation to anaesthesia—I.
	3.30	PROF. W. W. MUSHIN—Some aspects of physics in relation to anaesthesia—II.
	5.00	PROF. A. J. HELFET—Hunterian Lecture—The mechanism of the medial meniscus of the knee mechanism—diagnosis and consequences.*

Wed.	18	9.30	DR. W. D. WYLIE—Anaesthesia and respiratory disease.
		11.00	DR. W. D. WYLIE—Anaesthesia and analgesia in obstetrics.
Thur.	19		First Membership Examination, D.L.O. Examination (Part I).
		9.30	D.P.M. Examination (Part II) and D.P.H. Examination begins.
		11.00	DR. A. J. W. BEARD—Pre- and post-operative care.
		2.00	DR. T. H. S. BURNS—The fire and explosion hazard in anaesthesia.
		3.30	DR. C. F. SCURR—Carbon dioxide homeostasis during anaesthesia.
Fri.	20		DR. J. G. BOURNE—Anoxia.
			Election of Fellows to the Board of Faculty of Dental Surgery.
		9.30	Dental Lectures and Clinical Conferences end.
		11.00	DR. J. F. NUNN—Physiological aspects of artificial ventilation.
		2.00	DR. J. W. THOMPSON—Local anaesthetics.
		3.30	DR. R. I. W. BALLANTINE—Anaesthesia for neurosurgery.
Mon.	23	9.30	PROF. A. KEKWICK—The assessment of cardiovascular disease.
		11.00	PROF. W. D. M. PATON—Mechanisms of neuromuscular block.
		2.00	DR. A. J. W. BEARD—Chlorpromazine and related compounds.
		3.30	DR. G. H. TOVEY—Transfusion therapy.
Tues.	24	9.30	DR. J. VANE—The actions of analeptics.
		11.00	DR. H. C. CHURCHILL-DAVIDSON—Principles of hibernation and hypothermia.
		2.00	DR. H. C. CHURCHILL-DAVIDSON—Circulatory changes during Anaesthesia.
		3.30	DR. J. B. WYMAN—Clinical implications of hypotensive techniques.
Wed.	25	9.30	DR. R. BRYCE SMITH—An appraisal of local analgesic procedures.
		11.00	DR. J. GILLIES—Anaesthesia for emergency surgery—I.
		5.00	DR. J. GILLIES—Anaesthesia for emergency surgery—II.
Thur.	26		Board of Faculty of Anaesthetists.
		9.30	D.L.O. Examination (Part II) begins.
		11.00	DR. T. C. GRAY—Muscle relaxants in anaesthetic practice—I.
		2.00	DR. T. C. GRAY—Muscle relaxants in anaesthetic practice—II.
		3.30	DR. G. JACKSON REES—Anaesthesia for children—I.
Fri.	27	9.30	DR. G. JACKSON REES—Anaesthesia for children—II.
		11.00	PROF. W. D. M. PATON—The paralysis of autonomic ganglia.
		2.00	DR. J. A. LEE—Special aspects of spinal and epidural analgesia.
		3.30	DR. R. P. W. SHACKLETON—The management of apnoeic patients.
			DR. RUSSELL M. DAVIES—Anaesthesia for plastic surgery.
			Anaesthetic course ends.

DIARY FOR JULY

Tues.	1		Final Membership Examination begins.
Thur.	3	11.00	Election to Council.
		5.30	MR. NORMAN C. TANNER—Otolaryngology lecture—Haemorrhage from the oesophagus.*
Fri.	4		Inaugural Meeting of the International Federation of Surgical Colleges in Stockholm.
Tues.	8		Final F.D.S. Examination begins.
Wed.	9	3.30	PROF. D. SLOME—Bernhard Baron lecture.*
		7.30	Buckston Browne Dinner.
Thur.	10	10.30	D.I.H. Examination begins.
			Quarterly Council.
			Election of President, Vice-President and Lecturers.
			Demonstrations at the Buckston Browne Farm (Afternoon).
			Final L.D.S. Examination begins.
Fri.	11	5.00	PROF. J. BRYANT CURTIS—Hunterian lecture.*
Wed.	16		D.O. Examination and D.T.M. and H. Examination begin.
Thur.	17		Final F.F.A. Examination and D.Phys.Med. Examination (Part I) begin.
Fri.	18		Board of Faculty of Dental Surgery.
			Annual General Meeting and election of Licentiate to the Board of Faculty of Dental Surgery.
		4.00	PROF. H. G. RADDEN—Charles Tomes lecture—Local factors in healing of the alveolar tissues.*
Wed.	23		D.Phys.Med. Examination (Part II) begins.
Fri.	25		Basic Sciences Lectures and demonstrations for Dental students end.
		4.30	DR. WILLIS POTTS—Moyhnihan Lecture—Respiratory emergencies in the new born.*
Thur.	31	2.00	Ordinary Council.

*Not part of courses.

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